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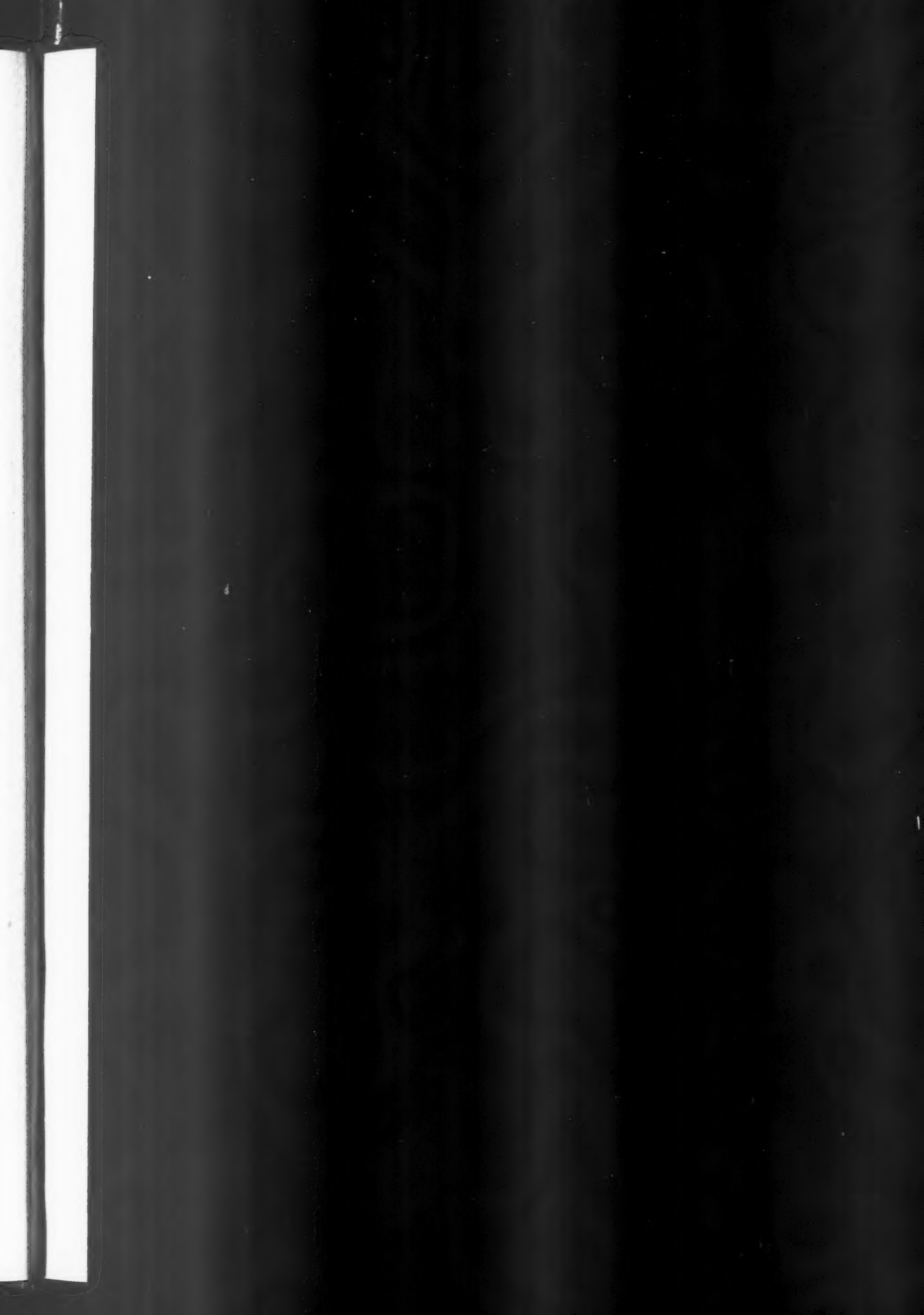


MUNICIPAL ENGINEERING

VOLUME XXX. MARCH, NINETEEN HUNDRED SIX. NUMBER THREE

THE NEW PHILADELPHIA RAPID TRANSIT SUBWAY.

By J. A. Stewart, Philadelphia, Pa.

A new era in public transit facilities in Philadelphia is heralded by the recent opening of a portion of the new subway and elevated. The division in operation includes the section from the west side of the Schuylkill river under Market street to Fifteenth street, just west of the City Hall. The distance traveled is about four-fifths of a mile.

The division opened for traffic embraces sections 1, 3 and 4 of the subway operation. Section 1 is the four-track bridge over the Schuylkill; section 4 is the east approach to the bridge and the portion of the subway to Twenty-second street; section 3 is the remainder of the completed subway from Twenty-second street to Fifteenth street. The other section on which work is begun is the two-track elevated structure from the Schuylkill river bridge to Sixty-third and Market streets, about three and a half miles in length.

It was on April 15, 1902, that the first step in the construction of the new Philadelphia subway was taken. On that date was begun the work of boring holes along Market street to ascertain the nature of the soil. In several places solid rock was struck and in others quicksand was found. But the latter was fortunately located at so great a depth below the surface of the street bed that its presence offered no menace to the underground tunnel.

Ground was broken for the subway April 6, 1903. Since then the work of tunneling under the chief east and west artery of travel has been going on steadily. Only the presence of a shaft or two, and the cutting off of one side of the street for a block or so from use, have indicated that something unusual was going on.

The subway as completed is a four-track underground avenue, with all the tracks on the same level, the three divisions being indicated by single lines of columns, five feet apart, which are bound together in pairs by cement envelopes at the bases, four feet five and one-half inches high, serving both to strengthen the columns and to act as fenders in the event of collision. The central division, or "core," is twice the width of the side partitions, and will be devoted to express trains solely. The total width of the subterranean passage is forty-eight and one-half feet. Its height is 14 feet, 5½ inches, the same as the Boston subway, which it resembles in many respects; and it is considerably higher than the New York subway.

In general construction the Philadelphia subway differs from those of Boston and New York only in the side walls. These are of solid concrete, 3 feet, 5½ inches thick, and are reinforced by vertical and horizontal rods near their inner faces. They are thicker than is theoretically required, owing to the contractor's desire to increase the section to facilitate construction by the methods adopted.

One of the most interesting features of the construction was the contractor's plan of work, to prevent the obstruction of street traffic during the building of the subway. Iron beams, ten feet apart, resting on immense wooden columns, supported the upper soil and pavement, the tracks and car tracks and subterranean pipes. Each of these beams weighed about 10 tons. Beams were permanently placed at intervals of 10 feet, alternating or rather interlacing with the intervals of the beams that were temporarily placed. Then after the new support for the earthen mass had been then substituted for the old, the alternate beams were dropped from their temporary post into

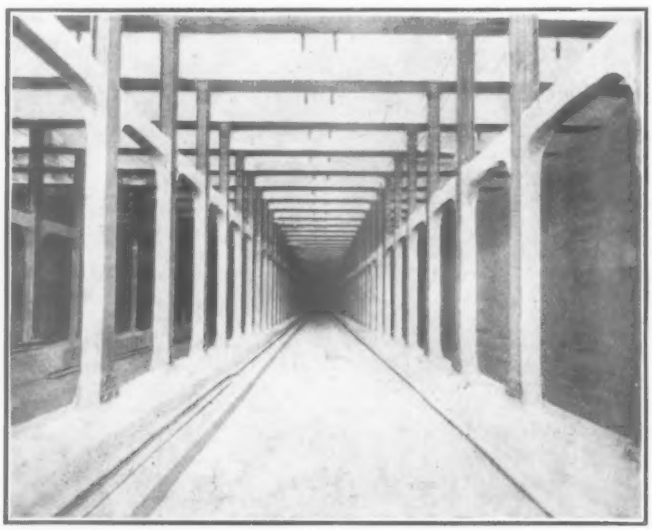
a permanent position, each on a pair of steel columns.

On top of the arches composing the roof is laid asphalt mastic one inch thick. The outer sides of the walls are coated with a species of burlap covered with waterproofing.

The problems of drainage and ventilation have been apparently thoroughly overcome in the Philadelphia subway. There is a 12-inch drain pipe under the floor, running lengthwise, and at intervals of 50 feet there are transverse feeding pipes, which lead the water that accumulates behind the walls into the main drains. All the drainage in the section now opened gravitates to Twenty-second street, where an automatic pump lifts it from an underground receiving chamber into a sewer.

Ventilation is by means of air shafts and ducts connected with the outside. It it planned to completely renew the air in the subway four times an hour, taking 1800 cubic feet of fresh air for each person, eac.ı hour, as the basis of requirement. In arranging the air chambers and ducts advantage has been taken of the proximity of the subway to the train shed of the Pennsylvania railway. The ducts touch the piers of the building in the form of masonry stacks, the stone facings of which correspond in material, workmanship and finish to the walls of the railroad structure. They are of concrete, reinforced by vertical and horizontal steel rods. A ventilating stack of masonry 60 feet high stands at Twenty-second street, in the base of which is a recess for the installation of an electric fan, if one is found necessary to keep the air good in the subway. Six other air chambers have been so arranged that electric fans may be installed if needed. But it is expected that the motion of the cars in passing will be sufficient to create a draught.

From Fifteenth street there is a gradual descent of the subway to Twenty-third street, where the tunnel turns north to the portal at Twenty-fourth street, by which the cars emerge from the subway to ascend the bridge over the Schuylkill. The bridge, which is a strong steel construction, carries four tracks, the two outer tracks being for surface cars in West Philadelphia. The two inner tracks of the bridge rise on an inclined plane to the elevated road section.



INTERIOR OF PHILADELPHIA SUBWAY.

Three stations form part of the Philadelphia subway section from the Schuylkill river to Fifteenth street. That at Fifteenth street is claimed to be the largest and most complete station ever erected in a subway. Entering one finds one's self in a spacious area, well ventilated and attractive. Four trains of seven cars each can be seen at a time within the roomy station, which is 375 feet in length and the full width of Market street, with entrances and exits on both sides of the street, so that conges-

tion of the traffic is a practical impossibility. The stations at Nineteenth street and at the east end of the Schuylkill river bridge are intended for local service only. The last named makes connection with the Baltimore & Ohio railway station at Twenty-fourth and Chestnut streets.

That the section of the subway now completed forms a vital artery of traffic through Philadelphia is realized when it is known that it affords direct connection between the railroad terminals of the Pennsylvania railway in West Philadelphia the Baltimore and Ohio and the Broad street station of the Pennsylvania railroad. The extension of the subway east on Market street will bring in line the Reading railway terminal, the Pennsylvania railway ferries to Camden and most of the large business houses of the city.

The general plan for the system, which is only in its initial stage, shows in addition a complete underground line the full length of Broad street. To these will be attached radial elevated lines in all directions north and south to Hestonville, Paschallville, Point Breeze, Frankford and Chestnut street.

The work, unlike that of Boston and New York, is in the hands of a private corporation, the Philadelphia Rapid Transit Company, to which in the days of free franchise gifts under what has recently become a malodorous era in civic administration, the city gave away all its rights and opportunities for future ownership. The single benefit reaped by Philadelphia, aside from the better service and more rapid transportation promised, is the provision of tubes and underground conduits through which the city can run telegraph, telephone and fire alarm wires.

THE IDEAL CONCRETE BLOCK MADE PRACTICAL.

By Louis H. Gibson, Architect, Indianapolis, Ind.

There is a quality in connection with handicraft which inherently commands respect, or disrespect. A well-built house conveys an impression of excellence and worth which we can not define absolutely, but which we feel nevertheless strongly and definitely. This proposition applies to everything that is made, be it a great structure, a bridge, a building, a garment, or any of the utensils of life. The makers of cement blocks may well bear this in mind. All of us are considering this question from various aspects. We are apt to particularize. One man says, "What machine shall I buy with which to make a good block?" Another says, "What kind of cement shall I use?" Yet another, "How shall I form my aggregate?" Yet others, "What shall be the character of the design?" It is not the block machine which makes the block, but it is the mind of the man who operates it. The block is affected by his purposes, by his general sincerity and his real interest in his work. A good cement block can be made in a cigar box. The principal object in casting it in a machine is to reduce the cost. It is simply a question of formation and tamping, so far as the machine is concerned, in its physical relation to the block.

It is not necessary to again go over all of the difficulties and troubles which have confronted us in the manufacture of the concrete block, but rather to consider what we may do to make the ideal block. When we have formulated the ideal, we have something to guide us in giving it practical material form. The commercial block must be an ideal realized. With the ideal constantly in mind, it will be ultimately realized. The blocks, as many of us know them, are the outgrowth of carelessness and indifference. The blocks, as we may know them, will be the outgrowth of seriousness and idealization.

There is nothing in the way of a structural building substance that can not be accomplished through the medium of concrete and the block machine or other means of forming concrete. Blocks are being made, the texture of which is as satisfactory as any stone that the world knows. Being made first in a plastic state, the forms which may be given them are illimitable. Through the exercise of intelligence, care and industry, any texture desirable is obtainable. Because of the variety of material which may be used in the aggregate, in the inert material, any color is possible.

It is to the aggregate that we must first give our attention. Not because it, alone, is important, but because it is the first operation in block making. The term "aggregate" is here used in its accepted engineering sense, which implies the inert material, the sand, the gravel, the broken or crushed stone, or other substances of like character. The question of texture, color and imperviousness is dependent on the character of the aggregate. It is

quite as important that this matter be considered carefully, scientifically and, if we please, according to good laboratory methods, which after all are nothing more or less than careful and practical methods, as it is that we consider cement in the same way.

Reference has been made before to the methods of the Bitulithic pavement company. This organization has probably gone farther into the consideration of the aggregate, in a scientific as well as in a business way, than any other essentially commercial body. They have been able, in laboratory practice, to so form the aggregate that the voids represent less than eight per cent. of the volume. This, however, they do not undertake to carry out in practice; but in the field they find no difficulty in reducing the voids to less than twelve per cent. In the reduction of voids to the lowest possible proportion is to be found the underlying factor leading to the formation of the ideal concrete. The illustration of the Bitulithic company's methods is given for the purpose of showing that it is done by business people, for business reasons, for the sake of the dollars, and not for the sake of developing a theory.

The writer does not expect that the makers of cement blocks will at once respond to this suggestion. He does expect that in due time all successful makers of blocks will accept and put into practice the principles as above enunciated. If one would take a block of stone, say one foot square, and break it into pieces, the largest of which will pass through a two-inch ring, he will find that he will get a little over half, in weight and volume, of the broken pieces into a box which is a foot square. The Bitulithic organization, in their laboratories, have gone so far as to pour in plaster into a broken mixture of this kind, with a view of determining the shape of the voids and the general sizes and forms of the larger bits in aggregate which they may have to insert to fill the voids, preparatory to mixing therewith the yet finer particles. It is by this method and through this careful practice that they have been able to reduce, in volume, the voids as low as 7.5 per cent. By recognizing the methods to be pursued in this ideal result, they have been able to determine the measure of their success in practical, outdoor field operations. The Bitulithic laboratory results indicate the possibility

SUGGESTIVE DECORATIVE FORM FOR CEMENT WORK.

DOORWAY IN CEMENT AND STONE.

There is something about sincerity of purpose and integrity which, when expressed through material and labor, is always recognized. It shows from the outside. The doorway shown in this picture indicates, in the first place, serious thought and consideration of the design, which necessarily is the beginning point of all artistic work, and then it indicates careful handicraft. In the plainer forms, in the pilasters, in the wall surfaces, in the mouldings, there are valuable suggestions for the cement block maker. No design will ever be represented in connection with these articles which is intended for absolute reproduction. If we can consider the spirit which controlled the designer and emulate it only as an intent or purpose to do good work and feel a desire to produce and reproduce something a little better than we have done before, we have made a beginning which will eventually lead the cement worker and the block maker to produce results which are artistically worthy of him. Working on this principle, the cement worker will soon be easily, naturally and profitably producing designs in quality, in enduring material, which he will be proud of and the people glad to see.

of a 1 to 13.3 mixture, and the practical results of a 1 to 8.3, though, as a matter of fact, there is injected into the mixture a proportion of cementing material slightly in excess of that amount. While it is true that this company uses a bituminous material, the general principle of the relation of the voids to the cementing substance is not disturbed. Bitumen takes its place while in a liquid form, after which it hardens, which fact is also true of cement. Few of us will consider the cement block proposition with the same thoroughness and care, or with the expectation of securing these ideal results at this time; but by knowing what has been done and what can be done, we are in a position intelligently to take the first step, which implies the idea of reducing the voids to a minimum and the necessity of determining just what they are and then injecting into the mixture only the quantity of cement that is essential for the purpose and positively and practically uniting the material aggregate.

When one says that he is using a 1 to 5 mixture, or a 1 to 4 mixture, or any other larger or smaller proportion of cement, he is indicating to the world that he has not yet conceived the first principles of successful block manufacturing. One can not make a statement of this kind intelligently unless he is acquainted with the material which he is using to form his block. This is the first vital step.

In handling ordinary sand, we do not get the proportion of voids below about 35 per cent and we are unable to reduce them much lower than 28 per cent by scientific methods. Through the use of the larger substances and grading from these down to the finest, which ultimately includes the cement in solution with the water, the cement afterwards taking its crystalline form, we reach ideal results. The larger the particles in the aggregate and the more gradual and constant their variation from the largest to the smallest, the better will be the concrete. The size of the particles in the aggregate naturally has its limitations and in the case of block mixtures, is dependent upon the thickness of the finished concrete and the character of the surface desired.

These general principles and suggestions, regarding the size, the proportions and the grading of the particles, are mentioned in this specific way not for the purpose of forming an absolute pattern or method, but rather for the purpose of establishing a principle and indicating a general means of practically reducing the proportion of voids to the smallest percentage.

The idea of changing one's method of doing anything in a productive way is more or less repellent to all of us. The concrete mixer or the manufacturer has for a long time been doing his work in one way. He has established a habit, a state of mind, and it is a natural instinct, growing out of habit, to do it in that particular way. The animal quality is always to do the same thing the same way. The more highly developed animals are less rigidly and absolutely controlled by habit. All improvements are met with opposition. So it is in the manufacture of concrete. Through the enunciation of foundation principles, through reiteration, through the result of small beginnings, the general practice of grading the aggregate in connection with the manufacture of cement blocks will become an established practice, a regular habit, an instinct, and then we will wonder why we ever did it in any other way.

On the basis above outlined, cement block makers will be able to make a relatively non-absorbent block. As now generally made, they are sure to be absorbent and the troubles on that account are sure to be continuous. All efforts to render blocks non-absorbent by coating and doping them with material which is not a structural part of the body must, of necessity, on principle, be failures. Blocks must be non-absorbent because of their structural quality and because of the character of the handicraft employed in their manufacture. The absolutely non-absorbent block is not expected, but that they may be made to compare with stone and brick in this respect is unquestioned, because it is done. It will be done by reducing the volume of the voids to a minimum and in no other way.

The strength of concrete would be very largely increased by reducing the voids and thus reducing the relative volume of cement necessary to fill them. Cement secures contact of the various inert particles, but it does not add to the strength of these particles. Desirable material which is used for the aggregate is, or should be, of greater crushing strength than the cement, and, on that account, it is desirable to use as large a proportion of aggregate and as small a proportion of cement as is possible to coat and unite the surfaces of the other substances composing the concrete. This statement has been conclusively proven by practical tests, wherein sand and an unnecessarily large measure of cement has been used, and then testing the concrete and comparing it with a mixture wherein no more cement had been used but where there had been a material addition of

larger particles of gravel or crushed stone. These tests are familiar to all who have followed the literature of cement working.

It is remarkable that cement workers should be so willing to accept the laboratory methods of testing cement and at the same time that they should have been so backward in recognizing and adopting the practical laboratory methods of considering and analyzing the qualities and values of the aggregate. One is just as important as the other, and a high grade of concrete, that which is relatively non-absorbent and that which has a large

SUGGESTIVE DECORATIVE FORM FOR CEMENT WORK.

measure of strength, can not be secured unless both the cement and the concrete are considered in the same scientific spirit.

Much of the trouble, confusion and uncertainty which has been experienced in connection with the investigations regarding reinforced concrete has been brought about, not through lack of definite knowledge with respect to steel and cement, but through a lack of care in the preparation and the practical use of the aggregate. The qualities of steel for structural uses are perfectly well understood and may be safely reckoned upon. The same is true of cement. When we come to unite steel, cement and the aggregate, the result is confusion, contradiction and uncertainty. The missing link is in the same careful, scientific consideration of the inert material that has been given to steel and cement. The whole system is in imminent danger of receiving a black eye, because of failure in important structures, owing to ignorant and careless concrete manufacturers. The principle of reinforced concrete has not been generally accepted and received in a practical way by all architects, particularly on account of its careless manufacture. The same principle applies to block manufacture and the same difficulties are met therein.

The public acceptance of the cement block is dependent not alone on its structural value in carrying the loads and upon its capacity to keep out the moisture, but for all important structures and for all purposes where used above ground, upon its appearance. This question of appearance relates not alone to the mouldings or decorative forms and the ornament, but necessarily to the character of the plain surfaces. This relates to texture. The quality of the texture is

dependent on all of the conditions which have been mentioned with respect to the formation of concrete in all its details. The same means which are adopted to render the block non-absorbent and to give it the greatest strength possible will also give a good texture. While we are making a non-absorbent block, a strong block, we are also making one which has the greatest artistic value. An excess of cement means a dull, lifeless surface. It implies a surface lacking in uniformity, one which is irregular in all ways. Free cement on the surface of a block is fatal to its artistic value.

The ideal surface of a block would present the aggregate free from cement on its exposed face, and there would be only a sufficiency of cement between the particles to unite and retain them. When one has so fabricated the concrete as to approach this result, he has done all that he can do in securing desirable texture, so far as it relates to the desired composition. He may improve the color and general appearance by the quality and color of the aggregate and the cement. If we use a dull colored sand and gravel and leaden colored cement, we must expect the same color in the block. If we use light colors in the aggregate and a light colored cement, we secure another result. If the aggregate is clear and sharp or sparkling in quality, we get a similar surface on the face of the block. No color which may be added will supply what we term texture. It will not supply texture where the sand is muddy or where the other particles of the aggregate are dull and lifeless in appearance. We have not yet progressed for enough to make a general use of color on any account. We must first have mastered the question of scientific concrete manufacture, independent of color. We must first study color and texture through the medium of the inert material. Good results have been secured through the use of limestone, quartz, marble and granite of varying color and qualities. For blocks which are used for the exterior of buildings, different colors of sand may be used, white or gray or yellow, but always clean sand.

Does some one say that the conditions and methods which have been outlined in the course of this chapter are ideal and are those which belong to the laboratory? That is true. Everyone who builds a house has an ideal. In order to meet this ideal, it must be attacked through the medium of scientific investigation. Success in the manufacture of any useful product is dependent upon the realization of an ideal. The successful business man is the one who secures, as nearly as possible, laboratory results in a commercial way and reduces the cost to the public, so that it is within the reach of all who desire it. Money is made by meeting the ideals of the general public. Money will not be made through the production of the muddy, leaden-colored, dead cement block with which we have been contending during recent years.

SOME SUGGESTIONS ON THE TESTING AND USE OF PORTLAND CEMENT. *

By E. S. Larned, M. Am. Soc. C. E., Boston, Mass.

The present remarkable development in the use of cement is the direct outcome of the careful and persistent observations and experiments of our engineers — mechanical, chemical and civil. There is not a structure of modern times built of natural stone or forms of burned clay that has not been duplicated in cement, and the latter is now meeting structural requirements hitherto impossible except by the use of iron, steel and timber, and its advantage over the latter materials in the matter of cost, durability and freedom from injury by fire and water is only just coming to be known.

The adoption of a standard specification for Portland and natural cements during 1904 by the joint committee of the American Society of Civil Engineers and the American Society for Testing Materials has proved a happy issue out of the maze of conflicting requirements the manufacturer has met with throughout the country in years past. It was perfectly natural, under such conditions, that doubt and suspicion of a product so little known should prevail among the uninformed, and the American manufacturer of Portland cement, and the agent for foreign cement as well, was often regarded as a necromancer when he was enabled, through his superior knowledge

* A paper before the National Association of Cement Users.

and experience, to demonstrate that a cement in question was all right for use. Before the adoption of the standard specification (and even to-day to some extent) much conflict of opinion was found upon some of the most vital principles governing the acceptance of cement. Each tester or engineer performing this duty was a law unto himself and exercised the full prerogatives of his official position in fixing requirements and interpreting results, oftentimes prescribing tests that were misleading and fallacious as an indication of quality, and only served to vex and hamper the manufacturer, and in such cases an effectual barrier was set up between the very interests that have since combined and co-operated to the great benefit of all concerned.

With an experience covering nearly eighteen years upon important hydraulic construction, I have found opportunity to observe many variable conditions affecting the requirements and use of cement, and I know of no material entering into construction of which so much is expected that is subjected to the same or equal abuses, and when a failure is recorded, happily very few, how common it is to see the cause ascribed to the cement.

Once asked to explain the difference in results obtained by two testers working together, using the same amount of water in mixing and following the same method of molding, etc., I offered the somewhat parallel case of two cooks making bread from the same barrel of flour, same yeast and same formula throughout, and yet the quality and appearance of the loaves would be quite unlike.

The personal equation, perhaps, may not be removed in testing cement, but other conditions that vitally affect the results can be brought to a more uniform basis, and these, in ordinary ractice, may briefly be summed up as the quantity of water used to produce a paste or mortar of given consistency, time and manner of manipulation, method of molding, temperature of water and air, time and conditions of exposure in air and water, and rate of applying the load.

When tests are made under the instructions of the standard specification by an experienced and skilled operator they form a record valuable not alone to work in which the material is being used, but to all users of cement who may have access to the results. Uniform tests under a standard specification serve to show:

First—Whether the material meets the standard or fixed requirements.

Second — Uniformity of the product tested.

Third—A comparison with other brands of the same material, which is invaluable at times when making a selection and computing the real relative net values.

The small or casual user of cement hardly finds it expedient or necessary to attempt a chemical analysis or test for specific gravity—in fact, when he is using a well-known and established brand he need feel little concern about this, and the tests for soundness, sand-carrying capacity (which he determines by tensile tests of sand mortars), time of setting and fineness, altogether have a bearing on the chemical proportions and specific gravity that means much to the experienced observer.

Tensile tests of neat cement are useless in determining the real relative strength of one or several brands of cement, and the proportion of 1 cement to 3 of sand, by weight, should alone be considered in making comparisons. We use the cement with sand, not neat; consequently we want to know what to expect in our work. Many cements, both Portland and natural, give very satisfactory results in the neat test, but show marked inferiority compared with the best brands of both grades when tested for their sand-carrying capacity. Unless the standard Ottawa sand or crushed quartz be used throughout the test, we must recognize the fact that variable results will follow that are not due to the cement.

The effect of water in retarding the induration of cements and reducing their strength, particularly at short periods, has long been known, and more or less information has been published as the result of experiments made.

From personal acquaintance with a recent large work of concrete construction the writer is forced to the conclusion that when any reliance must be placed upon the cohesive strength of Rosendale cement within six months and perhaps longer, depending upon the exposure and local conditions, great care must be exercised in proportioning the amount of water used or, in the present day of wet concretes, in selecting a cement that successfully withstands the deteriorating influence of an excessive amount of water.

Cement or concrete construction, with or without steel reinforcement, is coming rapidly in favor, supplanting steel, stone, brick and lumber in all forms of construction, and it is but natural that mistakes and failures sometimes attend the efforts of the inexperienced and certain retribution is in store for the dishonest workers, but it is a remarkable tribute to this comparatively new material that so few failures have been recorded during the phenomenal growth of the industry. In fact, the failures in brick, tim-

ber and steel-frame structures are more numerous than in concrete construction, and yet all are chargeable to carelessness or dishonesty. Let us hope that each will serve as a beacon light to prevent a like calamity in the future.

Low first cost is not necessarily ultimate economy. If concrete did not perform its duty well and stand the test of time other materials would surely supersede it. It is of the greatest commercial importance to all in the industry that quality should be a first consideration. You well know how the slightest imperfection in concrete work is pointed out by hostile interests as a sign of inferority or faiiure, and a small crack that would be overlooked in brick work is viewed by the uninformed as a forerunner of sure and sudden collapse. Use only high-grade cement, select your sand with care and beware of sand containing loam or clay. Clean silicious sand, ranging from fine to coarse, gives the best results. Test it in combination with your cement before using. The ballast or coarse aggregate should also be clean and of varying size in order to reduce the voids to a minimum. Gravel and igneous rocks furnish the best stone for concrete, much better than limestone for fireproof construction. For crushed stone use a one-fourth-inch-mesh dust jacket on the sizing screen; you will then have a more uniform product. The amount of dust varies with the size, shape and character of the stone crushed, also depending upon the rate of feed into the crusher, the speed of the crusher and the degree of moisture in the stone. Stone dust, if clean, is better than almost any sand, but should be accurately gaged as sand, and more care is required to thoroughly incorporate it with cement because of the lareg percentage of fine material contained.

If crushed stone is stored or binned, as in most work requiring reserve stock, a more uniform mixture can be drawn from the bins when using if the dust be excluded. The latter serves to pack or cement the stone together, and alternating loads of coarse and fine will surely result.

In securing quality, thoroughness and care of mixing and placing concrete are of the utmost importance. Carelessness in placing will undo the work of mixing.

Proportions of cement, sand and stone will vary, depending upon the work to be done, but it is well to keep in mind:

First—That the stone voids should be a little more than filled with sand, and the sand voids a little more than filled with cement, if strength is desired.

Second — That the voids in ordinary sand vary from 30 to 42 per cent., so that if leaner proportioning than 1 cement to 3 sand be used the cement will not fill the voids and the mortar will be porous.

Third—Accurate gaging is essential to uniform results.

A word as to consistency or amount of water used: Wet concrete is the order of the day, and while I believe in using too much rather than too little water, still, in my judgment, much concrete is made too wet, and if in this condition much tamping, spading or forking be dohe the coarse aggregate will be driven to the bottom of each layer placed and a very unequal distribution of cement throughout the mass will follow. Except in the presence of very intricate reinforcement, the mortar should be of a consistency to easily support the coarse aggregate and admit of light tamping. Excess water serves to undo the work of thorough mixing.

With the view of determining the variability of wet mixtures, the writer made the following test this past year:

Gang molds were placed vertically over each other, eight in all, to represent a layer eight inches deep. The joints between molds were sealed with a thin layer of a mixture of white wax and tallow to prevent the escape of water. A high-grade Pennsylvania Portland cement was used in the proportion of 1 cement to 3 parts of standard Ottawa sand by weight, gaged with 20 per cent. water. Fine annealed wire (32 gauge) was inserted between each mold, and when the mixture had partially set, these wire were used to cut the gang molds apart, and the operation was satisfactory in producing perfectly formed briquettes. The briquettes were allowed to remain in the molds over night, under a damp cloth, and were then removed and immersed in water until broken.

The consistency of this mortar compares closely with much of the wet concrete now used, drier than some I have seen used in large work. When the molds were filled the mixture was churned and worked with a glass rod about one-fourth inch in diameter. The following results are the average of three briquettes, a total of forty-eight being in the series. No. 1 briquette is from the top layer and No. 8 from the bottom:

TENSILE STRENGTH IN POUNDS PER SQUARE INCH.

No.	*28 Days.*	*45 Days.*
1 (top)	336	386
2	288	392
3	225	354
4	255	318
5	222	292
6	219	289
7	288	241
8 (bottom)	303	265

The purpose of this experiment would have been accomplished in the test for one period alone, but it was deemed inexpedient to make the trial for any time short of one month. The inferiority of the briquettes in the bottom layers is clearly apparent, there being a maximum loss in strength of 117 pounds at eight days and 151 pounds at forty-five days.

It would appear entirely reasonable to assume that a greater variation would be found in a seven-day test than in either of the above two noted. Concrete, to be of the utmost value, should be a true monolith of uniform strength throughout. This is of vital importance in beam, girder and slab construction, and is not difficult of attainment.

This would seem to suggest that the idea is worthy of serious consideration, and further experiment in the line of compression tests also may bring forth interesting facts.

Another tabulation is also given showing the tensile strength of Portland cement mortar mixed in the proportion of 1 cement to 2 sand and gaged with different percentages of water ranging from 8 per cent. to 20 per cent.

Sand known locally as "Plum Island" sand was used. This is a dredged sand, very clean, selling at $1.60 per ton delivered. High-grade Pennsylvania cement was used. The results given are the average of three briquettes. Percentage of water used was determined on the combined weight of cement and sand. Briquettes were immersed in water until broken after remaining in a moist air close to twenty-four hours.

The injurious effect of using too little water is plainly evident in the 8 per cent. series, and requires no further emphasis. Up to six months the superiority of the drier mixtures, excluding the 8 per cent. series, is quite uniform, and it would appear that from 12 to 15 per cent. water would give the best results in a mortar of this composition—namely 1 cement to 2 sand. Fourteen per cent. water will yield a very plastic mortar if properly tempered.

TENSILE STRENGTH—POUNDS PER SQUARE INCH.

Water, p.ct.	8	12	14	16	18	20
7 days	261	443	392	368	338	301
28 days	344	470	447	436	422	407
3 months	344	490	494	491	457	454
6 months	392	543	536	497	472	430
12 months	300	463	478	434	446	474

It is gratifying to note the growing appreciation of the important part sand plays in all cement work. In many instances poor results are directly chargeable to the sand used. No cement will improve properly if mixed with very fine sand, and results will vary, depending upon the characteristics of the fine material. It must also be kept in mind that an intimate mixture of cement and fine sand is very difficult to attain, and a thorough distribution of cement throughout the sand voids is absolutely essential to good results.

Sand that looks good is not always above suspicion, and the following instance will serve to show the importance of testing the sand before use. An important hydraulic work was begun last spring in New Brunswick, and the contractors and engineers had congratulated themselves upon having what appeared to be an ideal deposit of sand and gravel for concrete work. The cement was thoroughly tested with standard sand and found to be "O. K." When everything was ready an active start was made and considerable concrete was placed before any doubts arose. It would not set up, however, in a week's time (or longer, it proved), and the cement was immediately tested again, with favorable results, and then some of the sand was examined. On the washing test it was noticed that a slight opalescence was imparted to the water, remaining in suspension several days, but leaving practically no deposit on sedimentation. The cement was then tested with this sand before and after washing, and the trouble was at once located. The sand and gravel were both washed thereafter and good results followed.

Few unwashed natural sands are free of dust of a loamy or clayey nature, containing a high percentage of organic material; and in specifications usually calling for sand clean and sharp and free from fine material, the importance of excluding this deleterious agent is recognized, but it is not always possible to enforce this absolutely, and from mechanical analysis of a large number of samples and casual inspection of sand in use at various points, I am satisfied that much sand is used that contains 5 per cent. dust, and a good deal that carries as much as 10 per cent., and even more in some instances.

The sand-mortar test is the true basis upon which to judge the value of a cement, and I believe the proportion of sand to cement should be the same as employed in the actual work of construction.

Cement users are coming to select their cement with more discrimination than ever before. Their increased knowledge of the subject and the more extended use of the material show this to be necessary, and the natural result, owing to the struggle for commercial supremacy among the manufacturers, will be a better and more uniform product.

JHELUM RIVER HYDRO-ELECTRIC POWER INSTALLATION IN BRITISH INDIA.

The Government of British India has for some time pursued a broad-minded policy in developing the latent possibilities of the immense and valuable country over which it exercises sovereignty, and its officials have interested themselves in providing for the future welfare and enlightenment of the native inhabitants. Among other laudable projects which the Government has instituted, has been the commissioning of some of the most capable Royal Engineers to plan for and construct public works such as would aid in the general advancement of the native industries and the development of the commerce of the country.

The first notable project undertaken for the generation and distribution of electricity was that of the Cauvery Power Scheme, located in Mysore State in southern India. Work on this plant was started in 1900, the initial installation being completed after many difficulties in June, 1902. About a year ago, the second installation or extension of the plant, consisting of 3,610 kilowatts generator capacity, was completed. This increased the possible output of the entire plant to 7,920 kilowatts, making it the largest hydro-electric installation now operating in Southern Asia, if not on the entire continent.

The chief credit for the completion of the Cauvery power plant is due to Major A. J. de Lotbiniere, R. E., deputy chief engineer of the Government at Mysore, who not only conceived the plan of the installation, but successfully arranged for the financing of the entire project, overcoming prejudices that would have deterred a man less sound in his convictions. He afterwards arranged for the purchase of the entire electrical and hydraulic equipment and supervised its installation.

The power scheme next to be undertaken after the Cauvery is the Jhelum power installation on the Jhelum river in Kashmir, in Northwest India. This power plant is to be installed near Rampur, about fifty miles below Srinager, where a six-mile conduit will give a head of water at the plant of about 400 feet. The present plans call for an installation of about 20,000 horsepower.

It is planned to use the power for operating the Kashmir section of the Jehlum Valley Railway electrically along its length of 180 miles. A single-phase system of traction will undoubtedly be installed. Possibly the most important immediate use to which the power will be put will be in operating dredges for the purpose of deeping the Jhelum river in the Kashmir Valley, and thus minimizing the floods, which, under existing circumstances, periodically devastate the entire country. The contemplated plant will also allow of the reclamation of a very large tract of land, and permit of the storage of water in Wular Lake above the power plant for sale to the Punjab Irrigation Department. Another important use of the power will be for operating the large silk factory at Srinager and also for supplying with current the electrical water heaters in the silk mill. In addition, the power will be utilized for other industrial purposes and for lighting in Srinager and in Abbottabad, Murree and Rawalpindi, prosperous towns in the British province of Hazara, lying to the west of Kashmir.

After successfully completing the preliminary arrangement for carrying on the important work connected with the Jhelum Power Installation, Major de Lotbiniere was instructed last May, by the Jammu and Kashmir State Council, acting for the Maharajah of Jammu and Kashmir, to proceed to Europe and America in order to interview the leading hydraulic and electrical manufacturers and to ask those selected to bid upon the machinery and materials for the plant. Carrying out these instructions, he visited the works of those leading manufacturers on both continents who were considered for the work and personally inspected their manufacturing establishments, as well as power plants in which their machinery was operating.

As a result of this careful investigation, Major de Lotbiniere, who had full powers for the acceptance of the tenders submitted, has recommended to his Government that the contracts for the entire hydraulic and electrical equipment be placed with firms in the United States.

The gravity conduit line for the power plant will be approximately 34,000 feet in length and for the upper 8,500 feet will consist of an excavated ditch lined with masonry. The remaining portion of the water channel will consist of a rectangular flume, or a wooden stave pipe such as have been installed so successfully in connection with plants of this character on the Pacific coast. The flume will have a capacity of over 500 cubic feet per second.

The forebay at the end of the gravity line and at the head of the pressure pipes

will be constructed of masonry and will be provided with special headgates. The sliding elements of the intake gates will be of timber, all iron and metal parts necessary for the construction of the gates being furnished by the hydraulic contractor.

The pressure lines will consist of riveted steel pipes designed with a factor of safety of five, each supplying one of the hydro-electric units. For each pipe line a standpipe and two special vacuum valves will be provided in order to protect the pipe against injury in case the water should be drawn out suddenly.

At the lower end of each pressure line the last length of pipe will terminate in a flange which will be bolted to a massive cast-iron thrust block that will rest on a heavy cast-iron sole plate or base. The latter will be mounted on a substantial masonry foundation and be held in position by anchor bolts. This fitting will be designed to take the entire hydraulic thrust of the pipe, an ample factor of safety being allowed so that under the most severe conditions there will be no strain on the branch piping in the interior of the power house. Each pressure line will consist of a riveted steel pipe varying in diameter from 30 to 36 inches, and a 54- to 36-inch taper pipe, 10 feet long, at the upper end. The pipes will be 790 feet in length and will deliver the water under an effective head of 400 feet.

The interior piping of the power house will consist of welded pipe with welded flanges, all piping and fittings beyond the thrust block being designed with a factor of safety of 10 and subjected to a test of 1½ times the working pressure for a period of five hours.

Twelve main units and three exciter units have been planned for the equipment of the power house. Each main unit will consist of a Doble tangential water wheel with automatic oil-pressure governor delivering 1,765 brake horsepower to the shaft, under an effective head of 400 feet. Each wheel will be direct connected to a 1,000-KW alternator, the speed of the unit being 500 revolutions per minute. The exciter units will each have a Doble tangential water wheel delivering 285 brake horsepower to the shaft under an effective head of 400 feet. The speed of the exciters will also be 500 revolutions per minute.

The hydro-electric units will be of the Doble standard two-bearing type, the wheel runner being fastened on the end of the shaft. For each of the main units there will be a high-carbon, open-hearth steel forged shaft and two bearings of a special ring-oiling type provided with revolvable bearing shells. The exciter water wheel runners will be mounted on the extended ends of the exciter generator shafts.

The water wheels will be equipped with ellipsodal buckets, needle regulating nozzles and centrifugal water guards. The regulation of the main units will be effected by means of hydraulic governors operating jet deflectors. For the exciter units hand regulation will be provided by means of the needle nozzles. The gate valves for each wheel will be of special construction with outside screw and yoke, bronze-mounted, with by-pass.

The power house will be of solid masonry construction and will have a wide veranda as a protection from the tropical sun. A double steel roof will be provided and two traveling cranes will be installed for handling the machinery. The transformers will be installed in a bay of the main building or in a separate structure.

The conditions under which the plant will be installed are decidedly out of the ordinary as compared with similar work in this country. The specifications for the electrical and hydraulic equipment stipulated that no single piece of machinery should weigh more than four tons when packed, for the reason that there is 200 miles of road transportation, including a lift over a range of mountains 8,000 feet high. Transportation in that section of the country is limited to bullock cart, and no single piece of machinery heavier than four tons can be transported, a total of five tons including the trollie (cart) being the maximum weight that can be hauled over the mountains.

Portland cement costs $7.50 per barrel delivered at the site, making its use prohibitive for heavy concrete work. However, there is plenty of natural rock in the vicinity, so masonry construction will be used for the walls of the power house and for the foundations of machines, intake, forebay, etc.

The entire hydro-electric installation will be constructed, erected, tested and placed in operation under the supervision of Major A. J. de Lotbiniere, R. E. Major D. Fraser, R. E., and Capt. Thomas, R. E., will act as his engineering representatives in London. Mr. A. C. Jewett, formerly of the General Electric Company, will serve as installing engineer for the Government. Mr. Jewett was connected with the installation of the Cauvery plant and his selection as erecting engineer for the Jheuum river installation comes as a well-deserved recognition of his ability.

We are indebted to the Abner Doble Company, of San Francisco, to whom the contract for the hydraulic installation has been awarded, for the information in this article.

CORRUGATED CONCRETE PILES.

That the supply of timber is decreasing with the destruction of the forests is a fact that is impressing itself on the building trades more strongly each year, despite the efforts of the Government to

OVER DRIVEN WOODEN PILES.

maintain the supply by systematic planting. Indeed, so scarce has timber become in some localities that the prices of building material have taken marked advances. To meet this advance by substituting other material for wood, Frank B. Gilbreth, the New York contractor, recently experimented with concrete piles, manufactured above ground and driven into position with the regulation pile driver, to replace the wooden product which, at the time of the experiment was not available. The success of this concrete substitute prompted further experiments which have resulted in the modern corrugated concrete pile, which offers so many advantages over the wooden product as to mark a distinct advance in the history of foundation work. In addition to the advantages in cost, the concrete pile is impervious to decay and to other influences which act on wood, and is accordingly more permanent than the ordinary pile. In longitudinal sectional these piles have a uniform taper from butt to point and have flat points. For the work illustrated the piles are 16 inches in diameter at the point. Each pile is cored in the center, the core being 4 inches in diameter at the top and 2 inches at the bottom end. Through the core a water jet is inserted for sinking the pile into place.

On each plane of the octagon sides of the pile is a corrugation whose section is a segment of a circle, usually from 2½ to 3 inches in diameter. The object of these corrugations is to give passages for the escape to the surface of the water forced through the center core hole in driving the pile, as shown in the illustration, and to increase the perimeter of the pile and thereby gain greater surface for skin friction. In addition to this corrugation increasing the perimeter of the pile, it is claimed that this reduction in area, together with that made by the core in the center, permits a greater surface for skin friction than can be had for any other form of pile with the same cubical

REINFORCEMENT FOR CONCRETE PILE.

contents. The piles are reinforced longitudinally and transversely.

To reinforce these piles, electrically welded fabric made by the Clinton Wire Cloth Co., of Clinton, Mass., is used. The

meshes are 3 inches by 12 inches; the longer dimension being lengthwise with the pile and of No. 3 wire; the horizontal or transverse reinforcement being of No. 10 wire. The meshes are electrically welded together, the reinforcement being gotten out from a wide sheet taking the form of a cone. No part of the reinforcement is closer than one inch from the outside of the concrete. In general only sufficient sectional area of material is put in the reinforcement to take the tensile stress caused by the bending action when handling the pile preparatory to driving; more reinforcement than this only being necessary when the piles are

TAPERED CONCRETE PILE.

used for wharves, piers, or other marine structures, where a considerable length of pile is not supported sidewise, or where they are subjected to bending stresses, which would obtain if the piles were used in connection with ferry slips or landings.

The process of making and driving the piles used by the Corrugated Pile Co. of New York is described as follows:

For molding the piles forms are made with 2-inch stuff gotten out to the required dimensions, the corrugations being formed by nailing pieces on the inside, whose section is the segment of a circle. The sides of the octagon are fastened to the ends, through which the core projects some 6 or 8 inches. At times while the molding of the pile is in progress, the central core is given a partial turn to prevent the setting of the cement holding it fast and thereby preventing its final

DRAGGING PILE TO PLACE.

removal. The stripping of the forms from the piles is usually done from 24 to 48 hours after molding, and from this time on great care is taken that there is a sufficient amount of moisture in the pile to permit the proper action for setting of the cement. This is usually accomplished by covering the piles over with burlaps and saturating with water from a hose; the operation of driving the piles not

HOISTING PILE INTO POSITION.

being attempted until the concrete is at least ten days old.

The outside walls of the building illustrated herewith are composed of piers with curtain walls between. The loads are centered on the piers, each of which

is carried on a group of four, five or six piles according to the load of about 25 tons each. The nature of the ground on which the building illustrated is founded is dry fill, from 15 to 20 feet in depth, overlying hard pan. The regulations of the building department demanded that the foundations be carried down to hard pan. The average depth of the hard pan is at or near the level of high tide, so that wooden piles, which require to be submerged, were not permissible. Figures were taken for masonry piers carried down to hard pan, but this method was abandoned in favor of concrete piles on account of the difference in cost. To ascertain the depth at which hard pan would be reached and to find the nature of the dry filling preparatory to driving, some thirty holes were bored at different

PILE READY TO DRIVE.

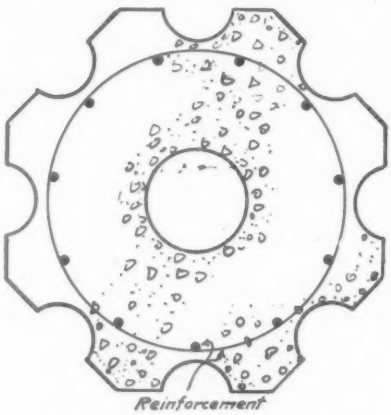
parts of the site. This was accomplished by using a 3-inch pipe with a 1-inch pipe placed inside of it in the form of a jet. In this way the nature of the soil at the different depths and the points at which hard pan was encountered were ascertained.

The operation of driving corrugated concrete piles is somewhat similar to that for driving ordinary wooden piles by water jet. The jetting is accomplished by inserting a 2-inch pipe within the pile. This pipe is tapered at the bottom end to 1-inch diameter, forming a nozzle, and the water pressure used is about 120 pounds per square inch. As a rule, this pressure is obtained by the use of a steam pump which may be connected with the boiler which operates the pile driver, or with a separate steam supply. At the upper end of this 2-inch pipe an elbow is placed and a short length of pipe is connected to this and to the hose from the water supply.

As it is not practicable to drop the hammer directly on the head of the con-

PILE HALF DRIVEN.

crete piles, the driving is accomplished by the use of a special cap. This cap is about 3 feet in height and the bottom end fits over the head of the pile. In one side of this cap is a slot from the outside to the center, which permits the 2-inch pipe, which supplies the water jet for driving the pile, to project. The outside of this cap is formed with a steel shell, the inside has a compartment filled with rubber packing and the top has a wooden block which receives the blows from the hammer. In this way the head of the

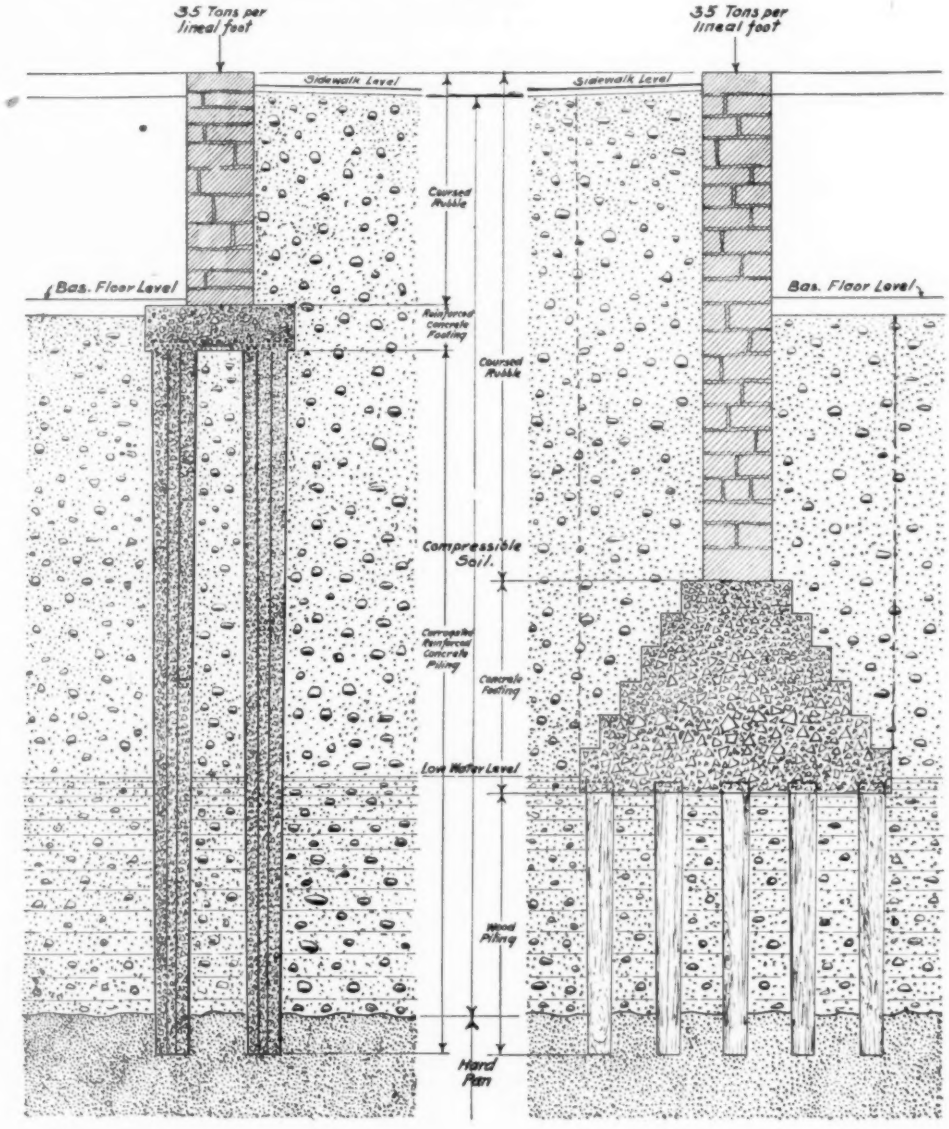


CROSS SECTION OF CONCRETE PILE.

pile is cushioned, which prevents the blow of the hammer from bruising or breaking the concrete.

During the operation of driving, the

water from the jet comes up on the outside of the pile and carries with it the material which it displaces in driving. This, with the assistance of the hammer, allows the pile to be driven into place, and contrary to what might be supposed, after the operation of driving when the water has saturated into the ground or been drained away, this operation puddles the earth around the pile, so that after a few hours' time the skin friction is much more than it would be with the pile driven into more compact soil without the use of a jet.



Corrugated Reinforced Concrete Piling — Wood Piling

FOUNDATION

SECTIONS OF PILE FOUNDATIONS.

EDITORIAL COMMENT

Bridge Architecture.

What is an Equitable Meter Rate for Water?

BRIDGE ARCHITECTURE.

The term "bridge architecture" is used, not in contra-distinction to bridge engineering, but to designate an artistic tendency which is developing in the country toward a consideration of the appearance of bridges and the design of their general forms and characters to suit their surroundings and their particular purposes. The day of strictly utilitarian structures is passing and many of the permanent bridges of the time are designed with some reference to their architectural effect.

We are so new in this business, however, that some monstrosities are perpetrated in the name of art which do harm to the cause and give some basis for the strictures made by Mr. Richard S. Buck in his presidential address before the Brooklyn Engineers' Club, in which he says:

When the architects agree among themselves as to what is correct and beautiful in those forms of construction which they have studied for centuries; when they can go beyond the now narrow limits of stock masonry construction; when they can fully understand the legitimate lines of development of steel and concrete; when they can refrain from cumbering the prime object of a work with a mass of finely drawn ideals and fancies; when they have eliminated from the field more legitimately their own the faults and controversies that crowd there; then they can with propriety demand that the material-minded engineer sit at their footstool and learn how to beautify his work. Until they do all this it behooves them to handle engineering problems with modest and gentle hands, and to devote themselves more assiduously to self-education in the rigid school of fact.

The controlling principle of engineering work is not to tickle the fancy or please the eye. This is even so of that unfortunately conspicuous form of engineering construction—the bridge. The bridge has serious, sordid, somber business to do, and it is seldom that conditions permit it to do this business with the same pleasing grace that we find in so many of our modern buildings—such as that temple of intellect that graces Longacre square. The Times building, or that glorious emporium of dry goods and art, the new Wanamaker store.

Some of us, for quite a while past, have been undergoing a heroic course of treatment in bridge aesthetics. All the way from the carefully studied French art of Hastings and the bold, variegated and versatile conceptions of Hornbostel down to the highly cultivated ignorance of Montgomery Schuyler and the New York Times and the calliope chorus of the Municipal Art Society we have endeavored to absorb and mentally digest. We have been yanked from a school of stern severity, utilitarianism and economy and translated to an atmosphere of aesthetics filled with colonnades, peristyles, facades, triumphal arches, lofty columns, architectural motives and skinned-face masonry, where it is a crime to breathe the word economy, and where steel and concrete construction are contemplated with as much abhorrence as a client who objects to the union rate for architectural services of "5 per." We are prayerfully hoping that this strenuous education will not develop mental appendicitis and that in time we may comfortably bear the proud title of "Doctor of Aesthetic Engineering." We are deeply grateful to those who would kindly lead us in the paths of better work, but it is "the back of me hand and the sole of me foot" to those who would drive us.

Mr. Buck would apparently have us believe that he still belongs to the class of the unenlightened, but this effect may be due to his personal interest in the contest over the architectural features of the new East river bridges which have been waged so hotly for several years, and in which the architectural forces seem to have been ranged upon the other side, with but few exceptions.

Notwithstanding Mr. Buck's variegated opinions of the architects, Mr. Montgomery Schuyler, in an article in "The Architectural Record," shows to the comparatively ignorant but unbiased outsider the material differences in appearance produced by the adherence of the engineer to "nothing but mechanical stability and efficiency" and by due attention to the demand which such a structure makes for opportunity to tell its own story and to tell it without interference.

Some of our great structures, designed solely by engineers have had this opportunity, and the first Brooklyn bridge, for example, tells its story simply and effectively, because it had but one or two relatively unimportant restrictions put upon it by the lack of knowledge in certain lines at the time it was built which caused some of its engineering features to clash, and by failure of the engineers to make all of its architectural features agree strictly with each other. But on the other hand we have the second bridge, the Williamsburg, which seems to have been run through a continuous brick machine and to have had so many hundred

yards cut off and hung by strings over the river.

The repetition of the Williamsburg mistake in the Manhattan bridge is what the architects and artists have striven to prevent, and it does not seem quite fair that they should be called hard names because they have been able to point out the horrible examples which they are striving to avoid.

Two end views of designs for the Blackwell's Island bridge, given in Mr. Schuyler's article, are enough to show the absolute necessity for consideration of architectural features if we are to escape the complicated mass of meaningless details which the original design contained. While that design may have been structurally accurate, it was far from correct from an engineer's standpoint, and was absolutely impossible from an aesthetic point of view.

There is another element in bridge architecture in which we are apt to fall short of perfection, even if we succeed in securing good designs. In our haste to complete our structures and put them to use we sometimes overlook the workmanship. Still worse, we are liable to slight it because good work costs money and we must save all we can, perhaps to drop it into the pockets of the grafters.

Excellent designs, ornamentation which is architecturally correct and artistic, may be made very ridiculous by intrusting it to stone cutters, to concrete mixers, to iron founders instead of putting it in the hands of sculptors or artists. We are very young in the application of art to engineering works and our mistakes give warrant for such diatribes as occasionally appear, and it therefore behooves us to take special pains to put our artistic work into the hands of artists. Thus we will educate ourselves with our fellows into a feeling for artistic construction which will soon produce great results in the beautifying of our public and private structures.

WHAT IS AN EQUITABLE METER RATE FOR WATER?

Two years ago the New England Water Works Association appointed a committee to consider the question of meter rates for water and to report concerning an equitable system of rates. The committee has not yet made a definite report upon the subject. This is not surprising in view of the many conflicting principles upon which the management of various works is based and the varying conditions under which water-works systems must operate. It will, perhaps, not be useless to discuss some of these variations and to attempt to show how they may affect a system of meter rates.

1. In the first place, a clear distinction must be drawn between works operated for private benefit and works under municipal ownership. It is undoubtedly true that both should be operated on the same principles, but so long as municipalities give up the control of their public service industries and fail to retain all their rights to determine how the public duties of the company shall be performed, we must expect that plants owned by private corporations shall be operated to make the largest dividends possible for their stockholders. The municipal plant, on the contrary, should be so operated that it will do the greatest good to the greatest number. It must first secure enough return from its operations to pay its way completely, and must then trim its course to distribute its benefits at the minimum cost and to the maximum extent possible. The municipality, as such, should not receive dividends from the operation of the works in the way of free water, payments to the general fund or otherwise, but is really entitled only to its share in reductions of rates, the city being only one of the practical owners of the plant, each of its customers having interest in its rates and management in proportion to his contribution thereto. The city is the responsible financial owner of the plant, and is legally responsible for the deficiencies of the plant or in its operation, but only as the agent for its citizens in general, and for that part of its citizens who are patrons of the plant in particular.

The private company will often fix its rates "as high as the traffic will bear," but to the municipal plant this vicious principle should be as impossible of application now as it will be for the private plant when the right of the municipality to fix the principles upon which the rates of the private company must be based is recovered and retained by its legitimate controlling power, the municipality itself. For the present, however, a system of meter rates for a private company would not agree in many particulars with a properly prepared system of rates for a municipal plant.

2. The city or town should be charged its proper share of the cost of furnishing water. Were the supply for domestic and manufacturing purposes only, this could be determined by meter readings, but most water plants supply fire service for the city also. Neither the amount nor the value of this fire service can be determined by metering the water actually used. It would be equally difficult

to determine it by any study of actual results in extinguishing fires. The cost of making the system large enough to supply the requisite fire pressures and amounts of water required for fire protection has been assumed most frequently as the measure of the value of the fire service. Hydrant rental seems to distribute this cost most equitably, though any material increase in number of hydrants would properly require a readjustment of charges. The interest on the cost of the larger pipes, larger pumps and larger supply necessary to keep the supply for fire extinguishing purposes always in readiness and the extra cost of maintenance, together with a fair depreciation charge, should be paid by the city from its funds raised by taxation. Water for public buildings, street watering, sewer flushing, etc., should be metered or carefully estimated, so that it can be paid for in proportion to the amount actually used. Only in this way can the citizens at large pay their proper share of the cost of the water supply. Any method whereby any one gets free water for any purpose is inequitable, since it makes individuals pay for general benefits or for benefits to individuals without their consent. In one of the discussions before the New England Water Works Association an example is given from the city of Holyoke. Of the 3,576 taxpayers in 1903 there were 2,338 who paid water rates. It is evident that any free water which the city receives or any payments to the general funds out of profits of the water company are paid by two-thirds of the taxpayers, who are thus subjected to the same inequity which caused so much trouble in the early days of English and of American history, the taxation of some individuals for the benefit of others. Not only this; the largest corporation taxpayer only used one-seventh as much water as the largest individual taxpayer, and the second largest corporation taxpayer used only one-hundred-and-thirtieth as much water as the second largest individual taxpayer. It is quite possible that the relations of the value of property protected from destruction by fire were reversed. In any event any benefit received by the city, directly or indirectly, from the profits of the water-works management which is not shared with the other consumers of water relieves the great corporation using little water of its just share of the cost of protecting its property and assesses it at a much higher rate upon the individual who is using the water, it may be, in running a motor in a building of no assessable value.

3. When the two subjects named have been carefully considered and the procedure proper to the individual case has been determined upon, the question of character of rates for private consumers may be taken up. Private fire protection, such as hydrants, sprinkler systems, etc., can not be measured by amount of water used, and may be estimated in a manner similar to that suggested for public fire protection or charged at rates proportional thereto on the basis of amount of water possible of delivery through the connections used. These uses are so relatively small a part of the total service, however, that they can well be omitted from consideration in fixing meter rates to meet all charges, and can thus serve as a safety factor.

Deducting from the total charges against the water plant the payments from the city, the remainder must be raised by assessments on the other consumers of water. We may assume that the amount of water furnished is a proper measure of the charge for supplying it, as practically true from the point of view of the water-works management and the rate per 1,000 gallons or cubic feet is easily computed from the assumed number of gallons supplied and the cost of supplying it. The cost of the fire service having been computed as above described, the cost of the individual service might be computed from an estimate of the cost of constructing and operating a purely domestic and manufacturing supply. If the sum of the two estimates does not agree with the actual cost of operating the existing plant, there is some local reason for adjustment of charges which must be taken into account, and the charge to the city must be increased or decreased accordingly.

From the consumer of water there has grown up a demand for wholesale rates on large quantities of water. The justice of this demand and the propriety of acceding to it, whether it is entirely just or not, must be determined as a general principle, and in each particular case. On the one hand we have the fact that so far as the supply of water is concerned it costs just ten times as much to pump 10,000 gallons as to pump 1,000 gallons, and in the long run the same is approximately true of gravity supplies, although there are a few small systems which are in the happy state that after the connections are made it makes no difference whether one gallon or one thousand is used by the consumer. If the charges which are more or less independent of the amount of water are taken care of by an independent charge, there seems to be no good reason why a large consumer should pay less than a small consumer per gallon for the water pumped to him. The discussion of these independent

charges comes later and this paragraph is restricted to the charges which depend on the amount of water furnished. If the city can afford to pump water for one consumer at 4 cents, it has no right to charge another consumer 12 cents for the same number of gallons.

The question of how much the traffic will bear comes up here immediately, and the driving or keeping of industries out of town by charging the standard rates is cited as justification for giving factories low rates. Free water or a low rate is given factories as inducement for location in a town, and the water plant is expected to furnish it. This is not equitable. The city at large benefits by the factory, not the patrons of the water works, and any free-water or low-rate propositions should be met by the city at large. It may or may not be legitimate for the city to give such inducements. If it is, the city should assume the burden and not lay it on the water-works system and thus upon the patrons of the same.

Then arises the question of the value of water for various purposes as a variation of the proposition to charge what the traffic will bear. Undoubtedly there are differences in value of water, but whether the city is justified in recognizing these differences is the question for discussion, and there is room for legitimate difference of opinion. Where there is plenty of water there is more room for variation in rates, but where the supply of water is limited the rights of the smaller consumers are paramount, and their use of water, whether at the same or higher rates, must not be interfered with. It is nearly always better to turn a large consumer over to his own supply for his cheaper uses of water than to restrict the supply or pressure for the smaller consumers. The large private companies recognize this principle, and the municipal plant which wants to deal justly by its patrons must recognize this also, and instead of trying to increase its revenue by getting large consumers at low rates and overloading itself should carefully study its schedule and revise it so as to get the necessary revenue by means of rates which will be just to all.

New plants may feel justified in ignoring most of these considerations during the period of development, but when the town or city is practically covered by the system their contracts should be in shape to change to an equitable basis.

4. There is no question that there are many items in a charge for water which are independent, wholly or in part, of the amount of water to be used. What these items are is not altogether determined, but they should be taken care of as completely as possible in fixing a schedule of rates.

Some cities take account of the value to a lot of a water pipe in the street by assessing a part or all of the cost of the pipe upon the lot. This is considered by some as hardly sufficient, and in a few cities a small annual water tax is placed upon every lot which has water within reach, this tax being collected as other city taxes are collected. Others make a charge at the beginning or annually, based on the size of the connection made, as the measure of the value of the water to the lot after the connection has been made. Others make a charge for meter, for meter rent or a minimum charge, to take account of this part of the value of the water. Nearly every plant using meters has some peculiarity in its charges. At this time it is only intended to call attention to the principles on which these charges should be made. The increase in value of the lot on account of the pipe in the street and on account of the connection made, any additional measure of value of the presence of the water on the premises, the cost of the meter, the cost of reading and recording and billing, and the cost of inspection are all items which depend not on the amount of water used, but upon the cost of the pipe, the increase in value of the lot, which shows on the tax duplicate, the cost of the appliances and of the service, and possibly upon the size of the connection. What shall be the fixed annual charge or the water tax rate will depend upon the local methods and conditions. It is possible also that some differences in conditions in various classes of buildings may vary these fixed annual charges. Then, if the principle of equal charge for equal amount of water supplied is used, the meter rate for water actually used will be uniform and the total sum charged will be made up of the fixed charge and the charge which is proportional to the amount of water used.

It is evident that no fixed meter rate can be recommended by the committee of the New England Water Works Association which will be applicable to all circumstances, and it is almost equally evident that even the principles upon which the rates will be fixed must vary in various systems. The best that can be done is to present the underlying principles of the establishment of the various parts of an equitable rate with suggestions of methods of fixing rates for special cases which will serve as guides for others in solving the problem for their peculiar conditions.

THE QUESTION DEPARTMENT

COST OF GAS.

I would be pleased to have you refer me to any articles published in your magazine regarding costs to construct and to manufacture illuminating gas, also rates on same.

R. D., ———, Ga.

There is but little published in detail upon the cost of building gas plants and cost of manufacture. Two articles in MUNICIPAL ENGINEERING by Alton D. Adams, give studies of the Massachusetts reports of operations of gas plants and the resulting cost and the prices charged. They are "Cost of Light in Municipal Gas and Electric Plants," in vol. xxiii, p. 160, and "Cost and Prices of Gas and Electric Lighting by Municipal Plants," in vol. xxv, p. 232. Regarding rates there is a table in vol. xxvi, p. 410, giving the rates charged in cities in the Central Western States. Brown's "Directory of American Gas Companies" ($5) gives the rates charged in all the cities of the United States. The books upon gas manufacture are not numerous and none of them give much concerning the cost of plants and manufacture. Data on this question may be found in English books to a slight extent, but are not directly applicable to American conditions.

HEATING POWER OF COAL, OIL AND GAS—BUILDERS OF CEMENT PLANTS.

I have been trying to find the comparative heat units between gas, coal and oil for burning cement. I would thank you very much for information on this subject; also for the names of some reliable engineers or builders for a modern cement plant. J. A. M., Kansas City, Md.

A cubic foot of natural gas yields from 1,000 to 1,164 heat units (B. t. u.) and a cubic foot of gas yields 630 to 735 B. t. u., according to quality. Water gas yields 290 to 327 B. t. u., and producer gas 137 to 156 B. t. u. per cubic foot.

To compare these figures with coal and oil, the following per pound of fuel may be used:

Coal gas, 17,800 to 21,696 B. t. u. per pound.

Water gas, 6,223 to 8,335 B. t. u. per pound.

Good average Pittsburg coal, 13,066 B. t. u. per pound, the average being from 9,215 for Arkansas lignite to 15,070 for Pocahontas semi-bituminous, and 15,198 for Kentucky cannel.

Petroleum, crude, 18,500 to 20,736 B. t. u. per pound.

Petroleum oils, 27,500 B. t. u. per pound.

Petroleum residuum, 19,500 B. t. u. per pound.

For names of reliable engineers and builders of cement plants reference may be made to the "Business Directory" printed in each number of MUNICIPAL ENGINEERING under the heading "Cement Plant Designers."

TUNNELS TO NEW YORK CITY.

Can you refer me to some one who can give me information concerning the number of tunnels now entering or being constructed to New York City, and their location? B. J. LAMBERT, Iowa City, Ia.

There are fourteen tunnels for traffic purposes now under construction to Manhattan Borough, New York City, as follows:

The old Hudson River tunnel, begun in 1874, has two tunnels, both of which are now very nearly completed, so far as the portion under the river is concerned, although it will be some time before they are in operation. They are owned by the New York and New Jersey Railroad Company and run from the vicinity of the Pennsylvania Railroad station in Jersey City to a Manhattan terminal in the block bounded by Tenth, Hudson, Greenwich and Christopher streets. The Hudson and Manhattan Railway Company has contracted for two more tunnels from the same terminal in Jersey City to a Manhattan terminal a few blocks away from the end of the other tunnels.

These two projects seem to be under the same control, and their construction is in the hands of the same contractor, the Hudson Companies.

The Rapid Transit tunnel under the Harlem River runs from Lenox avenue and One hundred and thirty-fifth street in Manhattan to Grand avenue in the Bronx.

The tunnel to connect the New York and Brooklyn subways runs from Whitehall street in Manhattan to Joralemon

street in Brooklyn. Both these tunnels are under construction.

The Pennsylvania Railroad is building two tunnels under the Hudson River from Jersey Meadows, N. J., to Thirty-third street and Ninth avenue, Manhattan, and four tunnels from Seventh avenue and Thirty-second and Thirty-third streets, Manhattan, to Thomson avenue, Queens Borough.

The New York and Long Island Railroad Company has recently contracted for the construction of two tunnels from Third avenue and Forty-second street, Manhattan, to Long Island City, Queens Borough.

There are several other projects which have not yet progressed to the point of letting contracts for construction, so far as public announcements have been made, and there are several tunnels and tubes for water, gas, wires, pneumatic transmission, etc., which are not included in the above list, which is restricted to transportation tunnels.

The chief engineer of the Board of Estimate and Apportionment of Greater New York, Mr. N. P. Lewis, can doubtless give full information regarding all tunnels, existing, under contract, or whose plans have been approved by the municipal authorities.

DRAINAGE OF KANKAKEE MARSH.

I would like to know what volumes of the proceedings of the Indiana Engineering Society have articles on the removal of Momence rock in the Kankakee River.

M. H. DOWNEY, Anderson, Ind.

Mr. John L. Campbell, who made in 1882 a State report on the proposed channel through the rock at Momence to make a better outlet for the Kankakee River, gave an address on the subject before the Indiana Engineering Society in 1894, and there is an address by W. M. Whitten and a letter from Mr. Campbell, with a map, in the proceedings of 1892. Mr. Campbell favored the project, and Mr. Whitten considered it of little value.

BUILDING AND MACHINERY FOR BLOCK BUSINESS.

I must build a building for my building material business, especially my block making, and would like some plans in regard to the same, also for conveying and screening machinery.

J. H. Nie, Lyndonville, N. Y.

Some ideas regarding the building may be gathered from Mr. Louis H. Gibson's articles in the current numbers of MUNICIPAL ENGINEERING and from Mr. Gibson himself. For designers of buildings and dealers in the machinery desired reference should be made to the "Business Directory" printed in each number of MUNICIPAL ENGINEERING under the headings "Concrete Building Designs," "Conveyors," "Conveying Machinery," and "Screening Machinery."

CREMATORIES FOR HUMAN BODIES.

Can you give us the names of any builders or manufacturers of crematories for incinerating human bodies?

D. G. C., Toledo, O.

The only American crematory for incinerating human bodies known to the writer is that of Dr. M. L. Davis, Lancaster, Pa.

WATERPROOFING CONCRETE BLOCKS.

I let a contract for the making of 25,000 cement blocks in November last and have about 7,000 on hand now, all to be made by June 1, 1906. I shall start to build all out of blocks a flat 44 by 132 feet plan and 2 stories high, for 10 families, next month, weather permitting.

The blocks are hollow. Do you consider it necessary for them to be waterproofed with some sort of waterproofing? If so, please inform me where I can procure the best.

V. B., Mishawaka, Ind.

There are two reasons for making blocks impervious to water, one to keep the water from going through the blocks and injuring plastering on the inside surfaces, and the other to prevent the differences in color of the outside surfaces which show while part of the blocks are wet and part are not.

There are other sources of moisture which, for some uses of rooms, would make it impossible to keep plaster on the inside dry, no matter how impervious the blocks may be, unless furring and lathing are used the same as on a brick wall. There is also the question of permanency of the waterproofing. These questions should be investigated before selecting an artificial waterproofing material. See the "Business Directory" printed in each number of MUNICIPAL ENGINEERING, under the headings "Antihydrine," "Damp-Proof Coatings," "Formulae," for names of manufacturers of waterproofing compounds. They can doubtless refer to customers who have had experience with them and can report whether they are durable and satisfactory. The writer can not state from personal experience which is the best.

It may be sufficient to meet the requirements of prevention of discoloration of the outer surface to make a dense block, by using the right proportions of cement and aggregate, by using as much water in the mixture as the process will permit,

by tamping thoroughly and hard or otherwise fully compressing the concrete, or by facing the block with a richer mixture. All these are advocated by practical block makers, and a judicious selection of method after careful experiment with the materials to be used will give satisfactory results.

Some of the best artificial waterproofing materials are not permanent, and if they are used, the waterproofing must be done over at intervals by applying the waterproofing to the wall after cleaning.

MAKERS OF MACHINES FOR PRESSING HOLLOW CONCRETE BLOCKS.

Can you furnish me with a list of manufacturers making power or hand-press machines, and refer me to someone competent to advise as to the feasibility of making concrete blocks with a core on same machine?

H. H. W., Cleveland, O.

The following make machines which subject concrete blocks or bricks to pressure in the process of manufacture: The Perfection Block Machine Company, Minneapolis, Minn., a hollow block; the American Hydraulic Stone Company, Denver, Colo., a "two-piece" block; Cement Brick Company, Port Huron, Mich. As there are about four new patents issued each week on concrete blocks, bricks and machines, there are others, doubtless.

CURING CONCRETE BLOCKS BY STEAM.

My idea is to build a curing room, say 150 feet long and wide enough to permit two tracks for the loaded cars containing blocks to be cured, and arch the same over on top and close it up with tight doors at either end, then turn the exhaust steam into this room, or kiln, and hold the blocks in it about four days. This plan will eliminate the necessity of watering the blocks, and, I think, will give uniformity in color. What, in your opinion, will be the effect on the quality of the blocks?

C. W. M., Memphis, Tenn.

The above inquiry is referred to this department by Mr. Louis H. Gibson. That curing by exhaust steam is practicable is shown by the answer to the same question which appeared in this department on page 18 of the January number. The following from Mr. J. P. Sherer's remarks at the Milwaukee convention of the National Association of Cement Users adds some interesting information:

"At the present time I am going through a series of experiments endeavoring to find a short time cure for our blocks, and applying steam for that purpose in indurating, as they term it. I find one difficulty in the induration or curing of blocks by steam is that with the aggregates that we have at hand to use we can not make as dense a block to cure as we would like to with steam, because the more porous your block is the less pressure you must use to dry a block successfully in, say, 8 to 10 to 12 to 24 hours with steam. We have been experimenting with exhaust steam with considerable success. However, we find that we get a better product when we put on a higher pressure of steam, and our blocks are dense enough so that the steam does not cause disintegration and separation of our aggregates."

APPARATUS FOR TESTING CEMENT.

At no very distant date I shall wish to purchase a simple outfit for the testing of cements. I shall desire to make most of the tests that are enumerated in your Handbook for Cement Users, except possibly those for tensile and compressive strength, especially the latter. I have everything that is necessary for all chemical tests, so you will understand about what I need. I will take it as a favor if you will advise me where I can get this apparatus most conveniently and inexpensively.

Z. N. V., City Engineer, ———, Ida.

Reference should be made for names of reliable firms supplying such apparatus to the "Business Directory" printed in each number of MUNICIPAL ENGINEERING, under the headings "Cement Testing Machines," and "Testing Machines."

INFORMATION ABOUT HOLLOW CONCRETE BLOCKS.

I am in search of reliable information regarding the hollow concrete building blocks, the machines for the manufacture of which are so extensively advertised. The question to be determined is in regard to durability. The blocks would be used in the construction of a church. I would also like to know the kind and grade of cement necessary to use.

R. L. C., Mayfield, Ky.

The durability of concrete block depends entirely upon the quality of materials used and the care with which the blocks are made. First-class blocks are unsurpassed for durability and are ample in strength for all demands. The blocks actually made range all the way from those which are eminently satisfactory from every point of view down through every grade to those which can scarcely be handled without breaking. The qualities of blocks should be studied and the best description of proper material and methods which has been published is Newberry's article on "Concrete Building Blocks," which has been printed as Bulletin No. 1 of the Association of American Portland Cement Manufacturers. It can be obtained by sending a postage stamp to

the secretary of the association, Land Title Building, Philadelphia, Pa.

AGGREGATES USED IN CONCRETE.

Is Portland cement used in combination with cinders, clay and white sand, and is it ever baked?

A. L. T., Elba, N. Y.

Concrete for floors and fireproofing is frequently made of cinders. Such concrete is not as strong as that made of other ordinary materials and this must be remembered in loading floors made of it. Clay is not regularly mixed with concrete, though it has been found that for lean concretes the presence of as much as 6 per cent of clay may be an advantage, increasing the strength of the concrete, because it helps fill the voids in the sand and gravel. Other very fine material is equally good. When enough cement is used to completely fill the voids in the concrete, the presence of clay is not so satisfactory.

Concrete is not baked, although heat hastens the setting of the cement, because a dry heat will evaporate the water from the concrete, and, since water is an absolute necessity in the processes of setting and hardening, the concrete would be weakened by evaporating the water. A moist heat, such as would come from the use of steam, either exhaust or under pressure, will supply the moisture and heat at the same time and thus hasten the setting and hardening without danger to the strength.

ARTICLES ON WATERPROOFING BLOCKS.

If convenient, will you kindly advise the writer of the numbers of your periodical which contain articles on the subject of waterproofing of cement blocks?

F. P. B., Lawrence, Kan.

Edwin Thacher's paper on "Concrete and Concrete-Steel in America," in vol. xxvii, p. 441, and vol. xxviii, p. 44, has some information on waterproofing concrete walls.

"Waterproof Cement," in vol. xxviii, p. 72, describes the new Star Stettin cement.

"The Waterproofing of Concrete Blocks," vol. xxviii, p. 138, by G. B. Kirwan, is a paper before the National Association of Cement Users.

"Waterproofing Concrete Structures," by W. H. Finley, on page 140 is another.

"Waterproofing Structures," on page 175 describes some special substances used for the purpose.

"Porosity of Hollow Concrete Blocks," vol. xxviii, p. 222, is a discussion in the "Question Department" of methods of increasing the density of concrete, and under "Waterproofing Concrete Blocks" and "Efflorescence on Concrete Blocks," on page 223, are additional instructions.

"Water Tightness of Concrete," by Taylor and Thompson, in vol. xxviii, p. 285, gives full descriptions of many methods used in monolithic concrete, some of which are applicable to concrete blocks.

"Plastering on Concrete Blocks," vol. xxviii, p. 313, and "Moisture on Concrete Block Walls, p. 317, discuss other sources of trouble from moisture and methods of treatment.

"Waterproofing for Building Materials" describes a water proofing solution, in vol. xxviii, p. 420.

"Waterproofing," by J. L. Mothershead, in vol. xxx, p. 105, is a paper before the National Association of Cement Users.

There are a number of less important articles in other numbers.

The Handbook for Cement Users ($3) contains some instructions in this line.

The numbers of MUNICIPAL ENGINEERING in which the above-named articles appear can be furnished at 25 cents each.

HOW TO MAKE CONCRETE BLOCKS.

The concrete building block has come to stay, but not as a majority of them are being produced at the present time. However, for a business that has had so short an existence we can not but approve of the interest and efforts of the amateurs (and nearly all are amateurs) in the business, who are not only anxious but determined to improve their product and styles, and to meet all requirements of architects and builders. To say what is the best way to make cement or concrete block at the present time would only be to develop discussion (what is wanted) and to bring out the experience of those engaged in their manufacture. There is one thing certain, cement blocks can not be made of sand and gravel alone, and it is not all that they should have the proper amount of cement, for the body 1 part cement to 5 of good, sharp, coarse sand and gravel, faced with 1 part cement in 2 parts fine crystal sand, but they must be well tamped and when placed on the yard should be under cover, well watered for at least four or five days in order to cure evenly and thoroughly, so that the corners and edges will be as strong as the center. It should not be a question of how many blocks can be made in a day, but how well. Then as to price there will be no trouble, as the demand today is greater than the product, and it will only be a short time until only the best will be wanted, regardless of cost, as when once placed in a building it is there to stay for not only years, but centuries.

A. J. RALPH, Indianapolis.

This letter is inserted because it may invite the discussion which Mr. Ralph desires, and additional details regarding the treatment of various materials. Mr. Newberry's paper on the manufacture of concrete blocks, published by the Associa-

tion of American Portland Cement Manufacturers, is an excellent basis, and whatever is sent in by correspondents will be published in this department if it adds anything to the information given in that paper.

CONCRETE FOR STEEP STREETS.

Will you kindly inform me how macadam concrete, as used for subbase of brick pavement, will work and wear when used alone for street pavements. Would macadam concrete be better than brick pavements on steep grade of 15 to 20 per cent rise? What is the best material on steep grades to reduce slipperiness to the minimum for horses? What construction of macadam is best for steep grades that will give good wear and the least repairing required? We have a couple of hills to do something with in the way of macadam or brick during the coming spring and summer, and we want the cheapest and best for the money expended. We have two miles of macadam streets in our town and now they are in a fearful condition owing to mud carried off of mud streets and the frost coming out, and the wet causes the macadam to stick to the wheels with the mud.

GEO. S. BRINKERHOFF, City Engineer,
Warrensburg, Mo.

Concrete has been used satisfactorily for level streets in Bellefontaine, O.; Grand Rapids, Mich.; Toronto, Ont., etc., as described in back numbers of MUNICIPAL ENGINEERING. The only objection to this material is that it is slippery, because the surface must have a finish like a cement walk to give the pavement its full measure of durability.

It is hard to conceive of a practicable street in a city with 15 to 20 per cent. grade. One of 10 per cent is beyond the limit of satisfactory use of asphalt and is not far from the limit for any other hard pavement, except stone blocks.

A steep macadam street requires constant attention to repair the damages from washing away of the materials by the rain. One method of minimizing this is to pave the gutters or to put the gutter in the middle of the street and pave it, giving the road crown or dip enough to turn the water to the gutter quickly. In one city the width between curbs is made large enough to permit a winding track for vehicles, thus reducing the slope for at least half the distance.

Stone blocks, well set, while expensive, are probably the most satisfactory for streets of more than 10 per cent rise and will be the most economical in the long run. A brick pavement laid with more than usually open joints will be the next best with bitulithic fully equal to it for lack of slipperiness and nearly, if not quite, equal for foothold. It is easy to lay a brick pavement so as to lose its advantage of foothold, by making the joints too close and filling them with hard material. Macadam is equally good as regards foothold and slipperiness, but disintegrates much more rapidly.

A good macadam street, well rolled and with its surface well filled with fine and hard material, should give but little trouble from picking up when wagons with muddy wheels run over it. A street not thoroughly compacted and, therefore, with many comparatively loose stones on it near its surface has been known to be carried away almost entirely in a single winter, so far as the areas next to mud streets were concerned, while one which had been thoroughly rolled and compacted and allowed to settle to its work during the drier seasons has stood the same kind of usage during the winter with but little damage. The macadam streets in Warrensburg were probably laid without thorough rolling and may have been finished so late in the season that the traffic did not have time to try to do what the roller had failed to do.

COMPULSORY ORDINANCES ON SIDEWALK MATERIALS.

I understand the city of Indianapolis has an ordinance compelling sidewalks to be of cement. If it is possible, will you send me a copy of the ordinance?

L. V. C., Wilmington, Del.

The city of Indianapolis does not have an ordinance compelling the use of cement sidewalks. The determination of the materials to be used in pavements is in the hands of the Board of Public Works, under a few restrictions regarding petitions for specific materials under certain conditions. It has been the policy of this board to encourage the use of cement sidewalks and to discourage the use of other materials. The practical result is, therefore, very nearly the same as though there were an ordinance fixing the material.

AMOUNT OF ASPHALT PAVEMENT.

Can you tell me how much pavement there is in the country and how much is laid in a year?

SUBSCRIBER, ———, Ill.

The latest information on this subject is contained in Bulletin No. 20 of the Bureau of the United States Census on "Statistics of Cities Having a Population of over 25,000 for 1902 and 1903." The amounts of these pavements in the various cities having asphalt pavements in 1903 are given in MUNICIPAL ENGINEERING, vol. xxix, p. 430, as taken from this report. To determine the amount laid in one year, the difference between the amounts in ex-

istence in 1902 and 1903 is taken and gives the following figures:

City.	Asphalt Laid in 1903. Square yards.
New York, N. Y.	2,041,147
Chicago, Ill.	927,000
Philadelphia, Pa.	257,041
St. Louis, Mo.	283,356
Boston, Mass.	1,141
Baltimore, Md.	10,989
Cleveland, O.	18,640
Buffalo, N. Y.	16,052
San Francisco, Cal.	128,490
Pittsburg, Pa.	98,611
Cincinnati, O.	52,247
Milwaukee, Wis.	8,246
Detroit, Mich.	38,613
Washington, D. C.	69,287
Louisville, Ky.	149,244
Minneapolis, Minn.	Reduction.
Indianapolis, Ind.	49,530
Providence, R. I.	5,279
Kansas City, Mo.	116,223
St. Paul, Minn.	99,956
Rochester, N. Y.	35,402
Denver, Col.	6,731
Toledo, O.	35,223
Allegheny, Pa.	32,850
Columbus, O.	5,275
Worcester, Mass.	2,439
Los Angeles, Cal.	4,693
New Haven, Conn.	0
Syracuse, N. Y.	17,255
Fall River, Mass.	0
Memphis, Tenn.	129,046
Omaha, Neb.	5,797
Paterson, N. J.	0
St. Joseph, Mo.	0
Scranton, Pa.	3,138
Lowell, Mass.	11,555
Portland, Ore.	40,552
Cambridge, Mass.	4,445
Albany, N. Y.	0
Grand Rapids, Mich.	Reduction.
Dayton, O.	0
Seattle, Wash.	34,118
Hartford, Conn.	0
Reading, Pa.	122,873
Trenton, N. J.	68,270
Nashville, Tenn.	0
Wilmington, Del.	0
Camden, N. J.	69,323
Bridgeport, Conn.	0
Trenton, N. J.	68,270
Troy, N. Y.	4,040
Lynn, Mass.	0
New Bedford, Mass.	0
Somerville, Mass.	0
Lawrence, Mass.	0
Springfield, Mass.	0
Des Moines, Ia.	52,414
Savannah, Ga.	0
Hoboken, N. J.	0
Peoria, Ill.	6,727
Evansville, Ind.	0
Manchester, N. H.	946
Utica, N. Y.	49,903
Kansas City, Kan.	7,403
San Antonio, Tex.	0
Duluth, Minn.	22,997
Salt Lake City, Utah	10,137
Waterbury, Conn.	0
Elizabeth, N. J.	0
Erie, Pa.	6,455
Charleston, S. C.	0
Wilkes-Barre, Pa.	0
Norfolk, Va.	53,780
Harrisburg, Pa.	43,149
Yonkers, N. Y.	0
Schenectady, N. Y.	61,560
Youngstown, O.	14,200
Holyoke, Mass.	0
Ft. Wayne, Ind.	57,825
Akron, O.	0
Saginaw, Mich.	39,672
Tacoma, Wash.	5,740
Covington, Ky.	0
Lancaster, Pa.	0
Dallas, Tex.	57,623
Lincoln, Neb.	24,715
Pawtucket, R. I.	0
Little Rock, Ark.	16,000
Spokane, Wash.	56,464
Altoona, Pa.	0
Augusta, Ga.	0
Binghamton, N. Y.	0
Mobile, Ala.	36,419
Soutn Bend, Ind.	0
Springfield, O.	0
Topeka, Kan.	0
Terre Haute, Ind.	0
Allentown, Pa.	4,726
Salem, Mass.	9,507
Elmira, N. Y.	20,120
Bayonne, N. J.	0
York, Pa.	0
East St. Louis, Ill.	0
Chester, Pa.	0
Rockford, Ill.	0
Sioux City, Ia.	51,264
Newcastle, Pa.	16,043
Passaic, N. J.	0
Galveston, Tex.	693
Auburn, N. Y.	21,580
South Omaha, Neb.	0
Joplin, Mo.	0
Joliet, Ill.	13,758
Chattanooga, Tenn.	1,711
Sacramento, Cal.	3,625
Oshkosh, Wis.	22,840
Newport, Ky.	0
Williamsport, Pa.	1,995
New Britain, Conn.	0
Cedar Rapids, Ia.	17,994
Jackson, Mich.	0

Seventeen cities did not report, viz: New Orleans, La., Newark and Jersey City, N. J., Atlanta, Ga., Richmond, Va., Houston, Tex., Bay City, Mich., Fort Worth, Tex., Wichita, Kan., Kalamazoo, Mich., West Hoboken, N. J., Hamilton, O., Lima, O., Newburg, N. Y., Aurora, Ill., Nashua, N. H., and Meriden, Conn.

The total number of yards of asphalt laid in 1903 by the 120 cities reporting this item for that year was 5,774,122, or a little more than 48,000 square yards each. If the other 17 cities laid a similar amount of asphalt, the total laid in 1903 was about 6,500,000 square yards.

The total number of square yards of asphalt in the 129 cities reporting for 1903 was 53,624,789, or about 415,000 square yards average per city. If the 8 cities not reporting are assumed to have the same average amount of asphalt pavement, the total amount of asphalt pavement in cities of more than 25,000 population in the United States was about 57,000,000 square yards in 1903. If we can assume the same increase in amount of pavement for each year 1904 and 1905, the total amount of asphalt pavement now in existence in these cities is very nearly 70,000,000 square yards. This is equivalent to 52,500,000 feet, or 10,000 miles length of street 30 feet wide, and the

increase is about 9 per cent each year. This assumption is justified since the amount of asphalt used for paving purposes, as nearly as can be estimated from the reports of the United States Geological Survey, does not vary more than 5,000 or 6,000 tons a year for 1903 and 1904. Reports for 1905 are not yet available.

AMOUNT OF PAVING IN CITIES.

Can you supply me with late information as to the number of square yards of asphalt, brick, macadam and new block paving in the principal cities of the United States? B. S. H., ———, I. T.

The latest information on the subject is contained in Bulletin No. 20 of the U. S. Census Bureau and gives the amount of paving in cities of more than 25,000 population for the years 1902 and 1903. The amount of pavement in each city in 1903 is given in MUNICIPAL ENGINEERING, Vol. xxix, p. 430. Elsewhere in this department will be found a statement of the amount of asphalt pavement laid in each city in 1903. Following is a similar statement regarding brick pavement:

City.	Brick Pavement Laid in 1903. Square yards.
New York, N. Y.	0
Chicago, Ill.	160,000
Philadelphia, Pa.	38,858
St. Louis, Mo.	453,702
Boston, Mass.	362
Baltimore, Md.	783
Cleveland, O.	199,939
Buffalo, N. Y.	12,492
Cincinnati, O.	142,148
Milwaukee, Wis.	49,491
Detroit, Mich.	103,569
Washington, D. C.	160,613
Louisville, Ky.	143,109
Minneapolis, Minn.	25,128
Indianapolis, Ind.	42,050
Providence, R. I.	[illegible]
Kansas City, Mo.	4,323
St. Paul, Minn.	40,076
Rochester, N. Y.	28,225
Denver, Colo.	4,154
Toledo, O.	143,582
Allegheny, Pa.	18,000
Columbus, O.	15,799
Worcester, Mass.	0
Los Angeles, Cal.	0
New Haven, Conn.	0
Syracuse, N. Y.	82,123
Memphis, Tenn.	0
Omaha, Neb.	2,314
Paterson, N. J.	0
St. Joseph, Mo.	53,424
Scranton, Pa.	20,762
Lowell, Mass.	0
Portland, Ore.	0
Cambridge, Mass.	2,976
Albany, N. Y.	12,652
Grand Rapids, Mich.	45,760
Dayton, O.	22,344
Seattle, Wash.	1,921
Nashville, Tenn.	Reduction.
Wilmington, Del.	4,113
Camden, N. J.	2,075
Bridgeport, Conn.	4,232
Trenton, N. J.	17,453
Troy, N. Y.	64,000
Lynn, Mass.	0
New Bedford, Mass.	1,045
Somerville, Mass.	0
Springfield, Mass.	2,080
Des Moines, Ia.	24,017
Savannah, Ga.	61,312
Peoria, Ill.	27,537
Evansville, Ind.	0
Utica, N. Y.	3,861
Kansas City, Kan.	16,017
San Antonio, Tex.	0
Duluth, Minn.	15,332
Waterbury, Conn.	2,948
Elizabeth, N. J.	0
Erie, Pa.	21,537
Charleston, S. C.	5,339
Wilkes-Barre, Pa.	5,866
Norfolk, Va.	2,276
Harrisburg, Pa.	0
Yonkers, N. Y.	3,720
Schnectady, N. Y.	2,406
Youngstown, O.	0
Holyoke, Mass.	3,754
Ft. Wayne, Ind.	33,124
Akron, O.	76,879
Saginaw, Mich.	14,984
Tacoma, Wash.	0
Covington, Ky.	16,364
Lancaster, Pa.	0
Dallas, Tex.	7,734
Lincoln, Neb.	15,841
Pawtucket, R. I.	0
Birmingham, Ala.	0
Little Rock, Ark.	0
Spokane, Wash.	0
Altoona, Pa.	876
Augusta, Ga.	2,152
Binghamton, N. Y.	14,320
Mobile, Ala.	19,579
South Bend, Ind.	64,205
Wheeling, W. Va.	34,510
Springfield, O.	0
Johnstown, Pa.	6,342
Topeka, Kas.	23,054
Terre Haute, Ind.	13,569
Allentown, Pa.	0
McKeesport, Pa.	13,200
Dubuque, Ia.	0
Davenport, Ia.	85,953
Quincy, Ill.	6,242
Elmira, N. Y.	14,080
Malden, Mass.	1,665
York, Pa.	0
E. St. Louis, Ill.	64,750
Springfield, Ill.	54,494
Chester, Pa.	0
Chelsea, Mass.	0
Knoxville, Tenn.	0
Rockford, Ill.	600
Sioux City, Ia.	22,964
Montgomery, Ala.	1,035
Newcastle, Pa.	4,360
Atlantic City, N. J.	0
Canton, O.	12,347
Jacksonville, Fla.	11,935
Galveston, Tex.	17,396
Auburn, N. Y.	0
Racine, Wis.	0
South Omaha, Neb.	0
Joplin, Mo.	0
Joliet, Ill.	989
Chattanooga, Tenn.	0
LaCrosse, Wis.	15,075
Oshkosh, Wis.	0
Newport, Ky.	0
Williamsport, Pa.	0
Council Bluffs, Ia.	22,215
Cedar Rapids, Ia.	18,051
Lexington, Ky.	0
Bay City, Mich.	85,221
Easton, Pa.	0

No reports were received from New Orleans, La., Newark and Jersey City, N. J., Atlanta, Ga., Richmond, Va., Reading,

Pa., Houston and Ft. Worth, Tex., Kalamazoo, Mich., North Adams, Mass., Hamilton and Lima, O., Kingston and Newburg, N. Y., Aurora, Ill., and Meriden, Conn.

The total number of yards of brick pavement laid in 1903 by the 127 cities reporting this item for that year was 3,111,807, or about 26,000 square yards each. If the sixteen cities not reporting laid a similar amount of brick, the total laid in 1903 was about 3,650,000 square yards. The total number of square yards of brick in the 135 cities reporting for 1903 was 32,708,076 square yards, or an average of about 242,000 square yards for each city. If the eight cities not reporting are assumed to have the same average amount of brick pavement, the total amount of brick pavement in cities of more than 25,000 population in the United States was about 34,600,000 square yards in 1903. If we can assume the same increase for 1904 and 1905 as for 1903, the total amount of brick pavement in cities of this size is now about 41,000,000 square yards, equivalent to 30,750,000 feet, or 5,864 miles of street 30 feet wide.

Taking the figures for 1903, the amounts of the various pavements in cities of more than 25,000 population may be compared as follows:

One hundred and forty cities reported 93,010,093 square yards of macadam.

One hundred and twenty-nine cities reported 53,624,789 square yards of asphalt.

One hundred and fourteen cities reported 41,745,210 square yards of granite and Belgian block, nearly 28,000,000 being in the ten largest cities, omitting Buffalo.

One hundred and thirty-five cities reported 32,708,076 square yards of brick pavement.

Fifty-two cities reported 23,378,485 square yards of wooden block pavement, more than half of this amount being in Chicago and Detroit, and Milwaukee having over 5,000,000 of the remainder, leaving but 5,000,000 yards for the other 49 cities.

Sixty cities reported 17,954,879 square yards of cobble stone, nearly one-third of this being in Baltimore and nearly 12,000,000 yards in the four cities of Baltimore, New York, Philadelphia and Buffalo, in the order named.

HANDBOOK OF STRUCTURAL FORMS.

To the list of handbooks of structural forms given in MUNICIPAL ENGINEERING, vol. xxix, p. 20, may be added Godfrey's "Tables" ($2.50) for structural engineers, and Sample's "Properties of Steel Sections."

BOOK ON SLATE ROOFING.

Can you refer me to some publication that instructs one in the use of slaters' tools (hand), more particularly as to removing broken slates and repairing roofs? I have three buildings with slate roofs all in need of some repairs and no one nearer than ten miles that knows anything about slating, hence will do work myself.

F. G. S., ———, N. Y.

The only book on the details of slate roofing known to the writer is the volume of the International Library of Technology on "Stair Building, Ornamental Ironwork," etc. It contains fifteen or twenty pages on the methods of laying slate roofing, but does not give great detail about tools. In Weale's Series is a little book on "Slate and Slate Quarrying" ($1.20). There is also a book on "Roofing' ($1.50), and one of the subjects treated in "Notes on Building Construction" ($3.50) is slating. The writer is not acquainted with the last three books.

SHRINKAGE IN MACADAM FROM ROLLING.

We have an argument concerning shrinkage on macadam work where the following conditions exist: The foundation is an old macadamized road worn down to a rough and uneven surface. The first proposition was to even up the surface by filling with dirt and roll the same to a good solid surface, but afterwards changed so that the old surface was not disturbed but to have the whole street filled with crushed stone (size 1½ to 3 inches) for the first layer and stone screenings washed in to fill voids, then rolled with a 15-ton steam roller; afterwards another layer of stone (size ½ to 1½ inches), which was also covered with stone screenings and washed to fill all voids and rolled to a good hard finished surface with 15-ton steam roller, leaving 9 inches thickness on the most shallow places in the center of street and where street was previously worn down probably left 14 or 16 inches deep in some places. The surface measurement is 6,000 square yards and the cubic yards of stone used in construction were 2,650 yards—all lime stone 2,600 pounds railway weight to the cubic yard. Will you kindly advise what percentage should the shrinkage be on t..at work or, how many cubic yards rolled stone as above would 2,650 cubic yards loose stone make?

. O. J., Racine, Wis.

In Gillette's "Handbook of Cost Data" ($4) is a statement made from the author's experience to the effect that 7.8 inches of loose stone, ½ to 2½ inches in size, will roll to 6 inches thickness and that 1.8 inches of screenings less than ½-inch in size will be required to fill the voids. This gives a total of 9.6 inches of the loose stone and screenings together to make a thickness of 6 inches of compacted macadam. If the number of cubic yards of stone given above, 2,650, is of the larger stone, it shrinks to 2,038 cubic

yards in rolling, but if 2,650 is the total number of cubic yards of the two piles of crushed stone and screenings, it shrinks to 1,656 cubic yards in rolling. This assumes a hard subgrade into which the stone will not be forced by the rolling and the macadam base described in the question probably has such a surface. To bring the finished macadam surface to finished grade might require 25 per cent. more loose stone if the subgrade were soft material, such as sand or wet soil or clay..

The Massachusetts Highway Commission says in its latest annual report that loose broken stone is found to be reduced one-third in thickness by rolling, without distinguishing between hard and soft subgrades, but assuming that the subgrade is well rolled.

BOOKS ON ESTIMATING COST OF ENGINEERING CONSTRUCTION.

Please refer to the best published works on estimating—that is sewers, reinforced concrete arches and bridges; also plate girders and truss bridges, concrete, stone abutments and piers. S. B.

Gillette's "Handbook of Cost Data for Contractors and Engineers" ($4) is a new book which treats the subject of cost of engineering work more fully than any other book and will give satisfactory service in the lines named in the question.

INFORMATION ABOUT SEPTIC TANKS.

Can you furnish me any information relative to septic tanks? Kindly furnish me a list of works that treat on septic tanks and sewage disposal.
J. B. W., Pine Bluff, Ark.

The back numbers of MUNICIPAL ENGINEERING are the best source of up-to-date information about septic tanks. Lists of articles on the subject which have appeared in the magazine will be found in vol. xvii, p. 336; vol. xxi, p. 80; vol. xxiv, p. 363, and vol. xxvi, p. 409, which will not be repeated here for lack of space. Since the last list appeared the following articles have been printed on this subject:

In vol. xxvii: "Sewage Disposal and the Septic Tank," p. 18. "The Use of the Septic Tank in Ohio," p. 34; "Sewage Disposal at Plainfield, N. J.," p. 37; "Sewage Disposal for Small Cities and Towns," p. 331; "Decision in Pawtucket Sewage Disposal Case," p. 385.

In vol. xxviii: "Patents on Sewage Disposal," p. 233; "Sewage Purification Plants in Ohio," p. 279; "Cities Having Septic Tanks," p. 448.

In vol. xxix: "The Columbus Sewage Testing Station," p. 34; "Septic Treatment of Sewage in the United States," p. 36; "Flush-Tanks for Sewers and Sewage Disposal Plants," p. 61; "The Treatment of Crude Sewage in Triple Contact-Beds," p. 109.

In vol. xxx: "The Tankage of Sewage," p. 36.

Reviews of books upon the subject are given as follows:

Rideals' "Sewage and Bacterial Purification of Sewage" ($3.50), vol. xxiii, p. 294; Moore's "Sanitary Engineering" ($7), vol. xxiii, p. 52; Dibdin's "The Purification of Sewage and Water" ($6.50), vol. xxvii, p. 219; Rafter's "The Treatment of Septic Sewage" (50 cents), vol. xxviii, p. 411; Baker's "British Sewage Works" ($2), vol. xxviii, p. 461; Dibdin's "Recent Improvements in Methods for the Bacterial Purification of Sewage" (25 cents), vol. xxviii, p. 462. Barwise's "Purification of Sewage" ($3.50), vol. xvi, p. 403.

HOW TO JOIN THE NATIONAL ASSOCIATION OF CEMENT USERS.

What does it cost to join the National Association of Cement Users and how can I get the report of the proceedings?
G. B. W., Geneva, O.

Only members can get the volume of proceedings issued by the National Association of Cement Users. The cost of membership is $5 a year and that amount sent to the secretary, Charles Carroll Brown, 310 Commercial Club Building, Indianapolis, Ind., with a statement of qualifications for membership will secure membership certificate and copies of the proceedings of the first and second conventions.

MUNICIPAL ENGINEERING publishes quite full accounts of the proceedings of the conventions and the numbers for February, 1905, and February, 1906, were very largely given up to them, since nearly every reader of the magazine is interested in one or more of the uses of cement.

MAKERS OF STREET SIGNS.

I would consider it a great favor if you can furnish men with the names of several concerns manufacturing street signs.
W. W. R., Niagara Falls, N. Y.

Following are the names of makers of street signs:

American Steel House Co., steel signs, 796 Eleventh avenue, New York City.

Ingraham-Richardson Mfg. Co., blue and white enameled signs, Beaver Falls, Pa.

Baltimore Enamel and Novelty Co., Baltimore, Md.

Enameled Steel Sign Co., 211, 18 State street, Chicago. Ill.

Will T. Cressler, 34 E. Sixth street, Cincinnati, O.

Jac. Murdock, Jr., Longworth street, Cincinnati, O.

Dayton Stencil Co., Dayton, O.

Trevor F. Jones & Co., 374 W. Broadway, New York City.

D. Elmer Roberts, Racine, Wis.

Wadsworth Engraving Co., Springfield, O.

Patrick & Co., 111 Sansome street, San Francisco, Cal.

FACING FOR CONCRETE BLOCKS.

Referring to the address of Mr. J. L. Mothershead, Jr., of Indianapolis, delivered at the Milwaukee convention and published in your February issue, we beg to say that Mr. Mothershead has been misinformed when he states that "all reasoning tends to condemn the method of facing concrete building blocks with a richer mixture than is used in the body of the block; that the result would be two rates of contraction and expansion in the same block, and the natural result would be a splitting apart of the two mixtures."

He states that a well-known block manufacturer showed him blocks so made, three years old, in which he found cracks between the facing and the body of the block.

For the information of Mr. Mothershead we beg to say that we hold a letter from this "well-known manufacturer," who, he states, "is progressive and conscientious," admitting that the blocks referred to, which he had previously exhibited to would-be purchasers of our system, were not faced with Portland cement, but with stucco that he had been experimenting with; that not to his knowledge had any of the blocks made under our system shown a separation between the face and the body of the block. We hold letters from a good many people who state that they were shown those blocks and were told that they were made under our system.

We wish to state that there is not, so far as we know (and there have been hundreds of thousands of blocks so made), a case on record where the face, which is usually of a 1-to-3 mixture, has ever cracked or separated from the body of our blocks, which are of a 1-to-7, 8, 9 or 10 mixture, depending upon the judgment of the manufacturer. It is ridiculous to suppose that a 1-to-3 facing (especially when made under heavy pressure) does not adhere more strongly to the body of the block than if the facing were of a leaner mixture.

THE AMERICAN HYDRAULIC STONE CO.,
Denver, Col.

Mr. Mothershead did not mention in his paper any particular method of manufacture or any particular manufacturer. While his statement, quoted above, is entirely too sweeping, it must be admitted that blocks faced improperly and without sufficient bond between the facing and backing are liable to the splitting apart to which he alludes. This does not condemn the principle, but only emphasizes the necessity of good work. There are thousands of miles of good cement sidewalks, but there have also been miles of sidewalk in which the top separated from the base on account of lack of bond between the wearing surface and the base. These failures warn us not to stop using sidewalks, but to construct them carefully and with good materials. The failures in facing blocks have come from ignorance or carelessness in manufacture or in choice of materials, and it is well to call attention to the results of such carelessness. There are certainly blocks enough made on many different kinds of machines with richer facing than backing to prove that the facing can be done successfully.

MUNICIPAL ELECTRIC CONDUITS.

Will you please give me such a list as you may have of the cities of the United States and Canada that own their electrical subways for underground wiring.

J. WALTER ACKERMAN, City Engineer,
Auburn, N. Y.

Erie, Pa.; Utica, N. Y., and to some extent Chicago, Ill.; Duluth, Minn., and Baltimore, Md., own conduits for electric wires. Most cities having such conduits have given the power to construct them to the companies owning the wires, in some cases under requirement that space in them be rented to other companies.

MAKERS OF REINFORCING BARS FOR CONCRETE.

Can you tell me where the Thacher and Ransome corrugated steel bars are manufactured? D. O. N., Bluffton, Ind.

The Thacher patent is controlled by the Concrete-Steel Engineering Company, Park Row building, New York city. The Ransome Concrete Machinery Co., 11 Broadway, New York, sells the Ransome bar.

REINFORCED CONCRETE BINS FOR HEAVY MATERIALS.

We are miners of fluor-spar, a very heavy material, and require considerable bin room. We have now in use some wooden bins, but as some of them have heretofore crushed down, owing to faulty construction or lumber or other causes to us unknown, and as we require more of them, it occurred to us to put up the new ones with reinforced concrete, and we want to know from you whether you could give us the names of those who would be competent to build such bins for us. We require a bin 200x24x20, inside measurement, and it should have four compartments. We are so situated that we could get a good foundation—practically solid rock—but we have been told a bin of this size could not be built strong enough. F. F. S., Co., New York City.

Names of competent engineers and contractors who can build the bins desired will be found in the "Business Directory" printed in each number of MUNICIPAL ENGINEERING under the headings "Civil En-

gineers," "Concrete Reservoirs," "Concrete Work," "Consulting Engineers," "Contractors," "Expanded Metal Construction," "Fireproof Construction," "Reservoirs."

HOW TO MAKE CONCRETE CELLAR WALLS.

I want to find out if I can make a concrete cellar 6 feet deep, 8-inch wall, from pounded sandstone and river sand.

M. T. M., Chautauqua, Kan.

This can readily be done, either using plank forms for both sides of the wall or the earth for one side if care is taken to keep it wet during the setting of the concrete. Possibly there is enough sand in the crushed sandstone. That can be determined, also the amount of cement necessary, by a study of the "Handbook for Cement Users" ($3), which gives full instructions on this class of construction.

WATER WORKS

Reading Water Meters—Rogers Park Case—Purification of Passaic River—Columbus Dam—Laporte Water Company—Reason for Water Meters.

How Many Water Meters Can One Man Read?

Negligence on the part of the city in reading water meters was charged before the council water committee of Chicago, recently. Aldermen Sullivan and Bihl, who made the charges, asserted that it was absolutely impossible for the city to properly read all the meters with its present force of employes, and that many meters were not read at all, and that charges were merely guessed at. Superintendent H. O. Nourse of the water collection division defended his department, asserting that if any injustice or laxity is practiced it is the fault of the present ordinances. It was shown that although there are 10,000 meters to be read there are only nine meter readers employed by the city.

The Rogers Park, Chicago, Water Case.

A decision has been rendered in the Rogers Park water suit by Judge Mack in which he holds that Chicago, by duty and law, is required to furnish to its taxpayers, and property owners in every part of the city water service equal so far as possible to that in any other part of the city. The Rogers Park Water Co. applied to the Circuit Court in January, 1905, for an injunction restraining the city of Chicago from proceeding with is plans to extend its water mains through that part of the city. The company based its contentions on the plea that the citizens of Rogers Park, before its annexation to the city of Chicago, by granting it a franchise gave it the exclusive right to lay mains and distribute water in that district. The city demurred to this and the decision sustained the demurrer. In giving his decision, Judge Mack says: "It is the city's duty to provide water service to all its taxpayers in all parts within the city limits." The water company was granted an appeal to the Appellate Court.

A Bill Providing for the Purification of the Passaic River.

A bill providing for the purification of the Passaic river was submitted at a conference of the citizens' general committee and these special committees of the Common Council February 6, at Newark, N. J. The provisions of the measure are practically the same as those which authorized the construction of the joint outlet sewer for Newark, Irvington, South Orange and several other municipalities. The compulsory character of former bills is eliminated and the measure seeks to have a trunk sewer constructed by cooperation on the part of the affected municipalities through the agency of the Passaic Valley Sewerage Commission.

The first section of the act contains a clause forbidding every municipality, corporation and individual of the State from discharging directly or indirectly any sewage or other polluting matter into the Passaic river at any point between the Patterson Falls and Newark Bay after May 10, 1910, and the Passaic Valley Sewerage commissioners are authorized and empowered to enforce the provisions of the act in all municipalities that may so offend. The commissioners are to notify

the separate municipalities within thirty days from the passage of the bill that pollution of the stream must cease by that date. Provision is made for the legal service of such notification on the proper official in each municipality, and the publication of the same in newspapers printed in Essex, Hudson, Passaic and Bergen counties for two consecutive weeks. The commissioners are also authorized to institute legal proceedings to enforce the provisions of the act, the Chancery Court being vested with special and summary jurisdiction. The Common Council or other governing body of any municipality that now pollutes the Passaic may determine by resolution that it is advisable and to the interest of the municipality, in order to comply with the provisions of the act, to cause the sewage now discharged to be intercepted by a trunk or main intercepting sewer and emptied into some safe and proper place. In case of such a decision being reached the municipality's governing body may request the sewerage commissioners to prepare and submit plans, maps and specifications for the construction of such a trunk or intercepting sewer, and of the necessary works for the discharge and disposal of the sewage, together with an estimate of the probable cost of construction, operation and maintenance thereof, an estimate of the capacity required by each municipality discharging sewage into the river, and also an estimate of the said cost of construction and maintenance which should be fairly apportioned to each municipality. The municipality or municipalities requesting such plans are to pay for them to the sewerage commissioners, and the latter are authorized to prepare such plans and specifications when one or more of the municipalities interested shall request them. The act further provides that the governing body of the municipality or municipalities receiving the plans and estimates of cost shall submit them to the governing bodies of the other municipalities discharging sewage into the river, and thereupon, if the said plans, maps and specifications shall be approved by these governing bodies, constituting municipalities enough to cover at least half the apportioned cost as figured by the commissioners, then the municipalities so approving are authorized and empowered to enter into a contract with the commissioners for the construction, operation and maintenance of a trunk sewer.

The act goes on to describe the nature of the contract to be entered into between the commissioners and the municipalities, providing that the percentage of the capacity to which each is entitled shall be fixed, together with the percentage of individual cost. The contract may provide for the construction of a trunk sewer of sufficient size to dispose of sewage for future needs, as far as can be foreseen in the future, and may differ substantially from the preliminary maps submitted, the several municipalities being vested with absolute discretion in determining the size and capacity of the sewer which may be built.

The act provides that in apportioning the expense regard shall be had to the benefits which shall be conferred on the persons and property in each municipality, and in the contracts provision is to be made for the repair, rebuilding and cleaning of the sewer, and it is further specified that in any contract entered into with the Passaic sewerage commissioners the municipalities shall undertake and agree, upon the request of the commissioners, to exercise and put in operation their powers of eminent domain for the condemnation of lands or rights in land for the benefit of the joint enterprise.

Full power is given the commissioners in the making of the contracts to purchase or acquire by condemnation in their names all lands necessary for the construction of the sewer, and they are authorized to proceed with the building of the sewer. The compensation of the commission and the incidental expenses necessary to maintain its corporate organization, pay clerks and counsel are to be deemed part of the cost of the sewer and paid for by the municipalities in the proper proportion.

Authorization is given to the commissioners in building the sewer to pass through territory within the bounds of any municipality other than those contracting for the drain, and to pass along, under or over any water course, street, highway, railroad, public or private land, provided no unnecessary obstruction to travel is imposed.

Contracts involving a cost of more than $5,000 are to be duly advertised and bid upon, and municipalities contracting for the sewer are authorized to issue bonds to raise the money, provided that no greater interest than 6 per cent. be paid. Provision is made that municipalities that may decide after the sewer is begun to share in the benefits be allowed to participate on payment of a proper part of the cost. In case the money paid in by municipalities joining in the work at a late date is not all needed it shall be apportioned among the municipalities originally making contracts. When the sewer is completed the control and charge of it is vested in the sewerage commissioners. Provision is made that if any part of the act or any provision shall be held to be unconstitutional the same shall not be held to affect any other section or provision. The necessary repealing and enacting clauses bring the act to a close.

The New Columbus Storage Dam.

The city of Columbus first began to be interested in a storage reservoir in the Scioto River on December 5, 1879, the date of the completion of its filtering gallery system to a direct connection with the Scioto River at the present intake, about a mile above the West Side Pumping Station. This interest was manifested by the payment from time to time during the next five years of sundry bills for the repairs of the Rickley mill dam, and by the construction of a temporary dam of "gravel" just below the intake, when the Rickley dam was at last wholly destroyed by floods.

In 1886 the city had plans prepared by John B. Gregory for a low permanent dam at this intake, but finding that the flowage rights would cost an unexpectedly large sum, the project was laid aside in favor of additional filtering galleries.

In 1893 Rudolph Hering reported a storage reservoir as necessary and suggested the Scioto River as better than other available streams. In 1895 the city revived the project for a low dam, contracting for its construction, but failing to secure the approval of the State Board of Health, the plan was not realized.

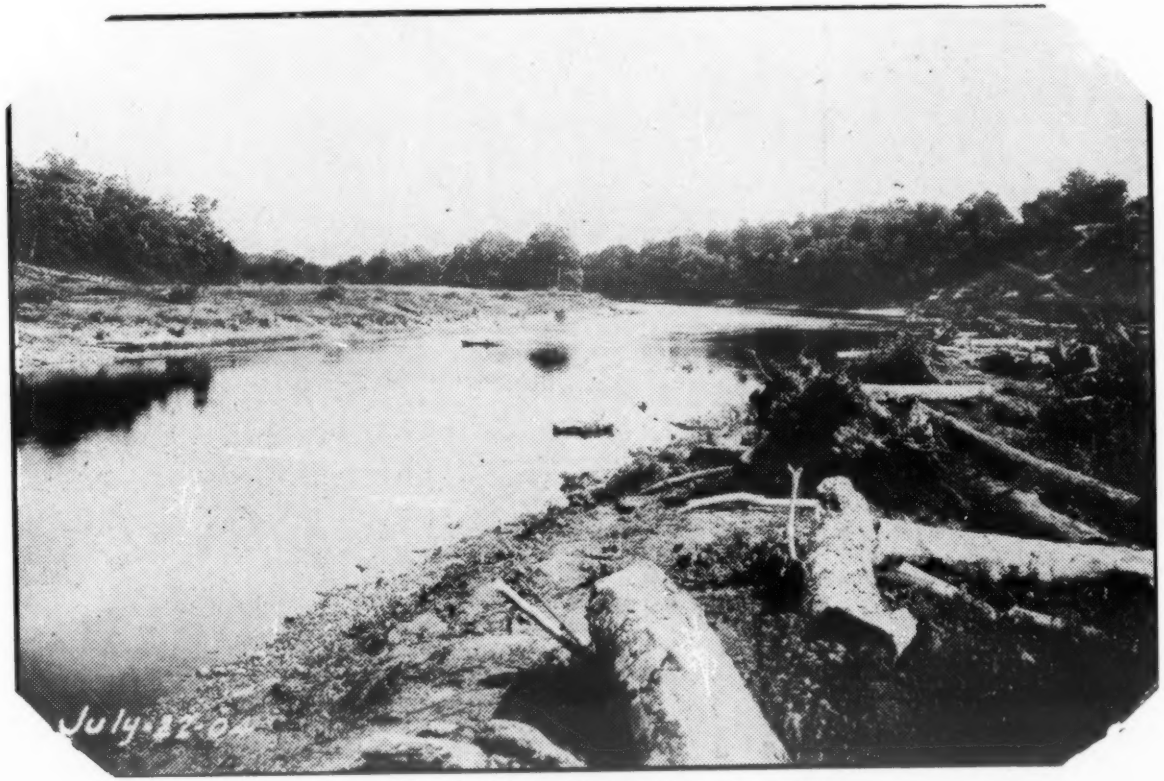
In 1896 the city purchased an interest in the Fishinger mill dam and also projected a dam 22 feet high at the Wyandotte site, procuring therefor necessary options covering flowage rights.

In 1897 more complete and extended surveys of the Scioto River were begun, and as a result of the investigation, in a report dated February, 1898, the present Lakin site for a concrete masonry dam was recommended.

At the spring election of that year bonds to the amount of $175,000 were voted by the people for a 30-foot dam at that location. In passing upon the plans the State Board of Health recommended a 50-foot dam, a recommendation subsequently concurred in by James D. Schuyler, who was called in consultation by the city in July, 1898.

COLUMBUS STORAGE DAM, COMPLETED.

The project of building the base of the larger dam to a height of 30 feet then first took form, and bids were subsequently received by the city for a dam on these lines in September and October, 1898; in February, 1899, and in July, 1902. All of these projects failed by reason of legal objections sustained by the courts. Some progress was made, however. A large portion of the necessary land was purchased at an expenditure of about $100,000 and the city irrevocably committed to the undertaking.



SITE OF COLUMBUS STORAGE DAM JULY 22, 1904.

In the meantime the purpose of the city was strengthened by a report in 1901 on the whole water problem by Samuel M. Gray, who recommended the construction of a masonry dam at the Lakin site 52 feet in height. A number of suits in condemnation for acquiring title to property for the proposed reservoir were necessary, and the last of these was finally disposed of in the spring of 1904. Council had in the meantime voted bonds in the amount of $45,000 by an ordinance passed September 28, 1903; and in the amount of $550,000 by an ordinance passed February 8, 1904. The Board of Public Service advertised for bids to be received May 10, 1904, for the construction of the dam, for the Portland cement required in the concrete masonry and for the grubbing and clearing of the reservoir site. Under the proposals then offered, an award was subsequently made to James Westwater for the dam; to the Kelley Island Lime and Transport Company for the cement; and to the Hoover & Kinnear Company for the grubbing and clearing.

The contract with James Westwater for the dam was executed May 25, the work was commenced July 2 and the placing of concrete began October 21 of last year; active construction has gone steadily forward, weather permitting, and since June 22, 1905, continuously both day and night until completion.

The dedication ceremonies took place December 3, 1905. The accompanying pictures show the progress of the work, and the drawings show the general forms of its cross section. The dimensions are as follows: Length, 1,008 feet; radius of curvature of the dam, 800 feet; length of rollway crest, 500 feet; height of rollway crest above apron, 33 feet, or 30 feet above low water; height of abutment above apron, 55 feet, which is noted on the profiles, as the height of the future rollway for the high dam recommended in the engineer's reports, when constructed; depth of foundation below apron, 17 feet, very nearly the same as fixed approximately in the specifications; maximum width of dam at base, 66 feet; earth excavation, 13,400 cubic yards; rock excavation, 30,000 cubic yards; concrete in dam, 57,000 cubic yards; Portland cement used, 57,000 barrels. The reservoir is 6 miles long, has an average width of 490 feet, an area of 363 acres, and a capacity of 1,627 million gallons. The drainage area above the dam is 1,032 square miles.

The cost of the dam proper was $390,000, of the 472 acres of land affected, $150,000, and of the roads, bridges and incidentals $160,000, making a total of $700,000.

Julian Griggs, city engineer, has been the efficient chief engineer of the dam, to whom the high quality of the work is largely due, and Hering and Fuller were the consulting engineers. Several other consulting engineers have made reports upon the project at various times during the preliminary discussions. We are indebted to Mr. Griggs, whom the exigencies of politics have just removed from office, for the account of the dam and the photographs.

The Laporte, Ind., Water Supply Company.

The Indiana supreme court has refused to dissolve the temporary injunction forbidding the city of Laporte to make payments to the Laporte Water Supply Company sufficient to meet the interest on the $50,000 bond issue by the supply company. The city owns nearly all the stock of the company, which was organized to build a $100,000 water-works plant in order to evade the statute prohibiting the city from exceeding its constitutional limitation of indebtedness. The city entered into a contract with the company, by which the latter receives $10,800 yearly for pumping water from the Kankakee wells to the city water-works, and this money was used to take up the bonds as fast as they became due, paying operating expenses and interest on the bonds. Injunction proceedings were instituted by ex-Mayor Emmet H. Scott and other citizens, and the supreme court declared that the contract was void. When the city attempted to buy water and pay for the same on delivery, Mr. Scott and the property owners brought a second suit, which was decided February 15, and prevents the city from paying the company only such money as may be necessary to operate the plant and make repairs.

A Manufacturer's Reason for Meters in City Water Systems.

The Metropolitan Water Board informed George W. Wheelwright, a paper manufacturer of Hardwick, on the Ware River, that as soon as the State water supply grows inadequate they will take the Ware River watershed. Mr. Wheelwright advocates a bill compelling cities and towns which take their water supply from outside to meter it. He believes that by having meters put on the waste will be stopped, and he will thus have a chance to continue in business. He says:

Malden, Belmont, Milton, with meters, use 45 gallons per inhabitant; Boston, no meters, 119 gallons used.

Fall River, with meters, uses only half as much as New Bedford, without meters.

COLUMBUS STORAGE DAM.
In Process of Construction June 28, 1905.

SEWAGE AND GARBAGE

Septic Tanks for Regina—Garbage Collection and Disposal in St. Louis.

Septic Tanks for Regina, Canada.

Regina, Assa., has constructed a new sewer system under John Galt, of Toronto, consulting and designing engineer for the city, and uses the septic tank method of sewage precipitation. The tanks are built entirely of concrete with steel reinforcement.

Each tank measures 125 by 20 feet 6 inches inside measurement. The bottoms are dished and reinforced with ⅝-inch twisted rods in order to resist the thermal stresses. The water level is constant and gives a depth of 7 feet. The side walls are 12 inches thick, reinforced by vertical and horizontal rods and by pilasters, spaced 10 feet center to center at the points of support of the beams which carry the roof. This latter is composed of concrete floor-beams measuring 8 by 20 inches, and reinforced with 1¼-inch rods. These in turn support the purlins measuring 3 by 13 inches, and serve to carry the floor slabs, which are 4 inches thick, and reinforced with ⅝-inch rods. The beams, joists and floor slabs are all built in one mass, thereby making a perfect bond. Twelve manholes and ventilating chimney are built into the 4-inch floor. The tanks are entirely underground, with a cover of 2 feet of earth.

The interior walls of the tank as well as the floors are furnished with a 1-inch coat of cement plaster and afterwards painted with a wash of alum and lye.

Garbage Collection and Disposal in St. Louis.

In the discussion of the question of garbage collection and disposal in St. Louis there have been developed two plans which are shown in the recent reports, one the report of the Sanitation Committee of the Civic League of St. Louis, and the other a report by Howard G. Bayles, of New York, prepared under instructions from A. J. O'Reilly, the president of the Board of Public Improvements.

Extracts from these reports follow, which are intended to show the principal points in each argument.

The summary of the committee's recommendations is as follows:

1. Ordinances requiring householders to provide three separate and distinct covered metallic receptacles—for garbage, rubbish and ashes.
2. Ordinance compelling householders to separate the waste.
3. Daily collection of garbage during the summer or warm months; bi-weekly or tri-weekly collections during the winter months.
4. The purchase by the city of removable, water-tight, covered steel beds for garbage; covered steel beds for rubbish and ashes—so constructed that all will fit the same running gear.
5. The construction of five or more receiving stations in different sections of the city, equipped with lifting cranes and side tracks.
6. A contract with electric or steam railway companies to haul the loaded garbage beds from the receiving stations to the scow on the river or to the disposal plant; and to haul the ashes to abandoned rock quarries or dumps provided by the city.
7. The erection of a garbage reduction plant on the river outside the city limits by the city or by contractors.
8. The erection of a rubbish destructor within the city limits; the sale of the valuable parts of rubbish to contractors; and the burning of the remainder to generate steam for heating and lighting public buildings.
9. The available part of street sweepings and barn litter to be sold to the farmers and gardeners; the remainder to be burned in the rubbish destructor.
10. This will result in a saving of at least $100,000 annually over the present system or the incinerating system.

Mr. Bayles's points may be summarized as follows:

1. The collection of waste without separation of the garbage and rubbish, changing the existing ordinances to provide that all combustible refuse shall be carried to the incinerator rather than dumped into the river as at present.
2. The several incinerators can be located at convenient points on account of demonstrated freedom from nuisance.

Following are some of the arguments made by the committee in support of its positions:

The waste material of a city can properly be separated into three kinds, as follows:

(a) Garbage, which includes kitchen or table waste, dead animals, and all refuse animal or vegetable matters which are liable to decompose and become offensive to the public and a menace to health.

(b) Rubbish or miscellaneous refuse, which includes paper, rags, old clothes, shoes, straw, boxes, furniture, and such other combustible waste material as is daily thrown away.

(c) Ashes, which include not only ashes, but also tin cans, broken crockery and glassware, street sweepings, and other non-combustible waste material.

The average American city, according to

COLUMBUS STORAGE DAM NOVEMBER 22, 1905.

good authority, produces the following amounts of these classes of municipal waste, stated in terms of their percentage of the total weight:

Garbage.....12 to 15 per cent.
Rubbish..... 8 to 12 per cent.
Ashes.....65 to 76 per cent.

These three kinds of refuse are radically different in composition. Garbage, according to carefully made tests, contains approximately:

70 per cent. of water;
7 per cent. of rubbish;
3 per cent. of grease;
20 per cent. of fertilizer or tankage.

Rubbish contains practically no water and is entirely combustible. Ashes and the waste included under that head are in the main incombustible. This radical difference in the composition of the different kinds of waste has made the problem of collection and disposal one of the most vexing questions of municipal government.

The process of caring for the city's waste involves three distinct steps: the separation of the waste by the householder, the collection by the city, and the disposal in a plant or plants erected for that purpose.

Regarding recommendations 1 and 2:

Primary separation, i .e., the placing of the different kinds of waste material by the householder in separate receptacles, is absolutely essential to the proper collection of the city's waste. At present the city is collecting only the garbage, and the receptacles supplied by the people for this purpose are the merest makeshifts. Anything from a broken-handled market basket to a leaky dry goods box is permitted on the streets and alleys. This results in a befouled condition of the alleys which makes them decidedly offensive, especially on warm days. Moreover, the present crude system of brick receptacles on the rear of each lot into which the householders dump indiscriminately not only ashes, sweepings, paper, and other refuse matter, but often times garbage, are extremely and unsatisfactory. These receptacles are wide open and the ashes and other material are picked up by every breeze, scattered over the streets and alleys, and carried into the houses of the neighborhood.

Regarding recommendations 3, 4, 5, and 6:

The long haul from the extreme limits of the city—north, west, and south—to the one central dump on the river makes the collection of garbage much more expensive than is necessary. The total cost for collecting the garbage of the city and delivering it to the dump on the river will amount to approximately $116,900 for the year. This means that the city is paying $1.67 per ton for the collection of garbage alone.

In order to reduce the cost of collection to a minimum, it will be necessary to avoil these long hauls. There are two ways of doing this: either by the erection of five or more disposal plants in different sections of the city, so located that the length of the haul will be reduced to a minimum; or by the construction of five or more receiving stations in various parts of the city, equipped with street car sidetracks, driveways, and lifting cranes, so that the steel beds loaded with garbage can be lifted from the wagon gear and hauled to the scow on the river or directly to the disposal plant on flat cars provided by one of the street railway or steam railway companies.

The first method has at least one very serious objection to it. No section of the city will submit to the erection of a garbage disposal plant of any kind in its midst without a serious protest from its citizens.

The objections to the erection of a garbage disposal plant in any section of the city can not legitimately held against the establishment of receiving stations located at points selected with a view to avoiding the long haul. The wagons loaded with garbage will be at the stations for only a very short time, the garbage will in no way be disturbed, and none will be left at any station over night. The long haul can be made after business hours by trolley. The system of hauling at present in use in Washington, Cleveland, Indianapolis, and a number of the smaller cities has proven to be odorless and thoroughly satisfactory. Furthermore, unloading the garbage at the disposal plant by machinery will greatly reduce the present slow and expensive method of unloading by hand on Chesley Island, which has cost the city $44,015.25 during the past seven months. This means that the cost of unloading the garbage at Chesley Island is costing approximately $1 per ton. This per tonnage cost added to the cost of delivering the garbage to the scow on the river makes the cost of collecting and disposing of the garbage, under the present unsanitary method, $2.67 per ton. When this cost is compared to that of Washington, D. C., where the expense of a satisfactory collection and disposal by contract is only $1.39 per ton, the need for some better and more economical method in St. Louis is all the more apparent.

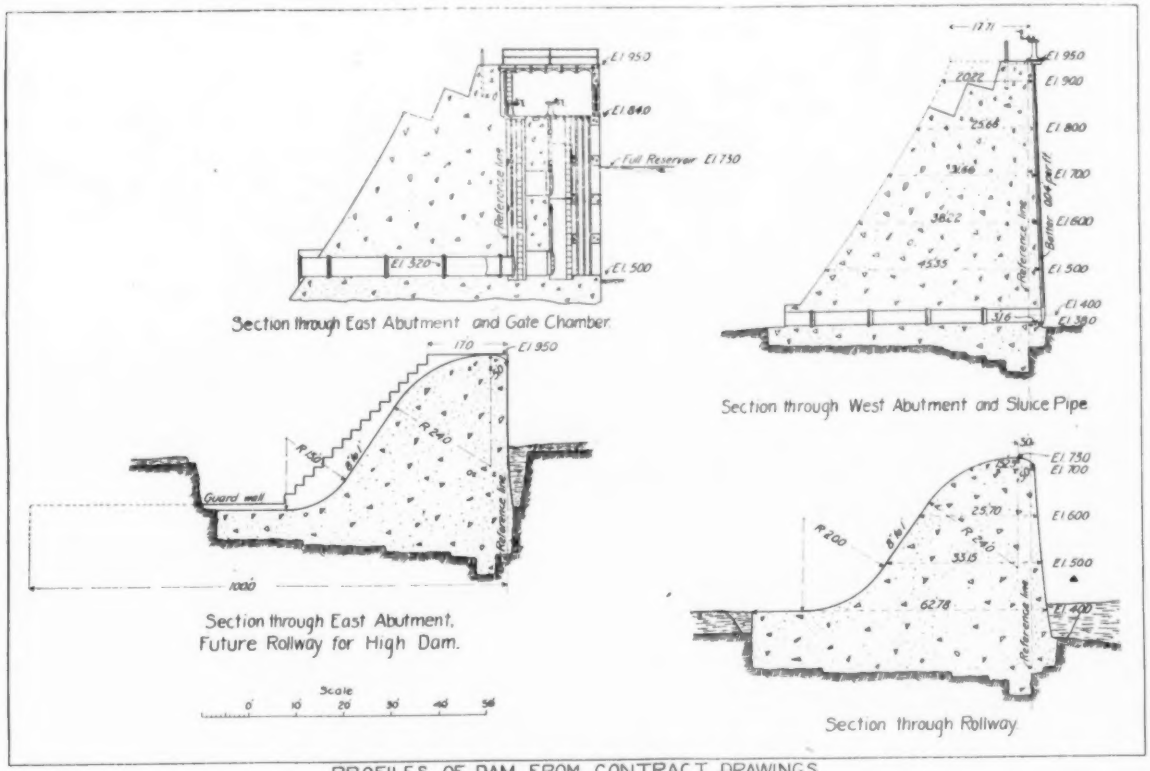
At the present time in St. Louis when the ash-bin is full, each householder is compelled to look up a teamster and pay him $1 or more per load to remove his ashes and rubbish to an abandoned rock quarry or public dump. The average annual expense to the householder for his work is not less than $5. Counting 100,000 householders for this city, which is a low estimate, this means an annual expenditure of at least $500,000 by the citizens of this city for the removal of ashes alone.

Ashes should be collected by the city, because this can be done much more efficiently and more economically by the city than by the individual householder. Separate covered wagons should be provided by the city for this purpose. Covered receptacles and covered ash-collecting wagons would reduce the dust and dirt in the city at least 30 to 50 per cent.

Regarding recommendations 7, 8 and 9:

Because of the very marked difference in the character of the three kinds of waste, your committee assumed that they should be separated by the householder and collected separately by the city. For the same reason it recommends the separate disposal of these three kinds of waste.

In England, it is true, the practice is to throw all the garbage, rubbish, and ashes into one receptacle, from which it is removed by the collector and hauled to the destructors, where it is burned with the addition of a small amount of fuel. The steam thus generated is used for electric lighting or pumping sewage and water. On the continent and in America, however, this method has proven unsatisfactory. Only two or three continental cities are using the incinerating process for disposing of all or part of its waste. Paris did



PROFILES OF DAM FROM CONTRACT DRAWINGS.

NEW COLUMBUS STORAGE DAM.

not find its plant sufficiently satisfactory to warrant adoption for the entire city. Berlin tests proved failures. In this country there is a fundamental difference in the elements which compose the garbage. We have not only a much larger quantity of garbage per capita, but it contains a much higher percentage of water; so that the situation in England can not be taken as a basis for determining the method of disposal in America.

Furthermore, unloading all waste into a furnace and burning it is at variance with the general principles of economy. According to this method of disposal the combustible rubbish, to which is added a considerable quantity of coal, is required to dry out the 70 per cent. of water in the garbage in order to put the other 30 per cent. into condition to burn itself. A ton of garbage contains 1,400 pounds of water. When this has been extracted by heat, there remains 3 per cent., or 60 pounds of grease, which is worth on the market today 2¾ cents to 3 cents per pound, or approximately $1.75 per ton of garbage. In addition, there remains 20 per cent. or 400 pounds of fertilizer, which is worth $7 to $7.50 per ton or approximately $1.45 per ton of garbage, making the total value of by-products per ton of garbage $3 to $3.20.

Further, a ton of rubbish, i. e., paper, rags, mattresses, old shoes, etc., according to actual test runs made in New York city, contains 48 per cent. of marketable material, chiefly rags and paper, for which the contractor pays $1.44 per ton of rubbish. The remaining 52 per cent. of combustible material will produce 85 to 90 horsepower of steam per ton burned, which, turned into electrical power, is equivalent to 50 kilowatts hours of electrical energy. St. Louis is paying 5 cents per kilowatt hour for electric lighting at the present time. The value, then of a ton of rubbish is:

48 per cent. of salable material, which is picked up by contractor	$1.44
52 per cent. of combustible material (estimated in terms of electrical power)	1.25
Total value per ton	$2.69

In other words, $2.69 worth of rubbish is burned to remove 1,400 pounds of water from a ton of garbage in order to prepare the residual 600 pounds, worth $3, for burning itself.

Why should a great city pay 40 cents to $1 per ton for the destruction, by burning, of the great quantity of unutilized waste which lies at its doors in the form of garbage and rubbish, the chief by-products of which—steam, grease, and fertilizer—can always find a market? The following table, compiled by the street cleaning department of New York in 1896, will indicate, in part, the value of these by-products:

Materials.	Per Week.	Per Year.
2,165 bbls. bones at 40c.	$866.00	$45,032.00
236,000 lbs. rags at 60c per 100 lbs.	1,416.00	73,632.00
55,500 lbs. carpet at 20c per 100 lbs.	111.00	5,772.00
45,100 lbs. grease at $1 per 100 lbs.	496.00	25,797.20
500 bbls. bottles $1.50 per 100 lbs.	750.00	39,000.00
327 bags broken glass at 10c.	32.70	1,700.40
39 loads registered bottles at $8.	312.00	16,224.00
20 loads iron, cast, at $5 to $6.	101.00	5,252.00
2,555 lbs. metal at 3c.	76.75	3,985.80
44 loads tin cans at $3.	132.00	6,864.00
49,200 lbs. paper at 25c to 50c per 100.	213.80	11,117.60
Total	$4,507.25	$234,377.00

This table was compiled when New York was dumping her waste in the sea and only a part of this salable material was saved. No part of the fertilizer from the garbage and the steam from the combustible rubbish was saved by this crude method. These by-products can not be effectively saved unless the different kinds of waste are disposed of separately.

There are practically three methods of disposal:

1. Dumping, by which the garbage is dumped into flowing water or on an island set apart for that purpose.
2. Incineration, by which the garbage is burned to an ash.
3. Reduction, by which the greases are extracted and the residue is made into fertilizer.

In determining the best method of the three named, there are points to consider. Is the process perfectly sanitary? Is it the most economical? and is it the most satisfactory to all concerned? No one will defend the first as being in any sense sanitary. For this reason, the present method in vogue in St. Louis, that of dumping the garbage on Chesley Island, should be dispensed with at the earliest possible date.

The second method—that of incineration—finds its strongest defense on the score of being perfectly sanitary. But incineration has proven a failure in so many cities in this country that it should not be adopted in St. Louis until after the most exhaustive scientific investigations of the elements composing the garbage have been made by experts to see whether or not incineration is feasible.

References are made to unsuccessful plants in New York city, Bronx borough, Pittsburg, Indianapolis, Atlanta, Washington, high cost in Wilmington, Del., and Grand Rapids, Mich., and reported complaints of odors at Atlanta and San Francisco.

It is only fair to say, however, that a number of our smaller cities are operating with apparent success, incinerators, where garbage, rubbish, and street sweepings are burned; but these cases are not sufficiently numerous to warrant the statement that the incinerating process has established itself in this country as a satisfactory and efficient method of garbage disposal.

These examples and the testimony of experts are cited not as conclusive evidence that the incinerator is destined to be a failure, but to enforce the statement that the process has not proven sufficiently satisfactory to warrant its adoption by St. Louis; and that an exhaustive investigation into the character of the garbage and refuse of this city should be made by a competent expert before a decision has been given in favor of incineration.

The same careful tests are not necessary if the reduction system is adopted; for this process has been used for years in most of the larger cities of this country. Where the reduction plant is properly built, properly managed, and not crowded too much, it is proving thoroughly satisfactory and sanitary. Cleveland, Washington, Buffalo, Toledo, and many other cities report no serious complaints from the residents of the city. A garbage plant of any type can not be operated carelessly or be over-crowded without becoming a nuisance. In order to avoid the possibility of a nuisance and to prevent the depreciation of property, which will inevitably result from the erection of a disposal plant of any kind within the city limits, the site for the location of the plant should be some distance beyond the city limits. The site selected should have both water and rail connections in order to insure, by competition, the cheapest means of transporting the garbage to the disposal plant.

From the economic point of view the arguments are strongly in favor of the reduction process. No incinerating company will guarantee the disposal of the garbage and rubbish with an actual profit to the city; and few contractors will agree to burn the garbage and refuse for less than 40 cents per ton.

In England, where incineration under the favorable conditions there present has attained its highest success, the cost of burning ranges from 20 cents to 60 cents per ton.

The reduction process, on the other hand, furnishes at least one excellent example of a municipally controlled reduction plant, which has operated for six months at an actual profit of over $3,000 to the city. This record has been made by Cleveland, Ohio.

The following figures are taken from the official reports of W. J. Springborn, director of the Board of Public Service of that city:

1. Gross income from the sale of by-products and other incidental sources	$30,013.75
2. Expenses, including labor, fuel, repairs, insurance, depreciation and interest on investment	26,579.59
3. Profit to the city	$3,434.16

New York has found the rubbish too valuable to be mixed with wet garbage and burned at a cost of 40 cents to 50 cents per ton. As has been pointed out, the street cleaning department of that city has found that 48 per cent. of a ton of rubbish is worth $1.44 to the picking contractor and the remaining 52 per cent. is worth at least $1.25 when burned and transformed into electrical energy.

The proportion of the rubbish of a city to the total waste is estimated by experts at 8 per cent. to 12 per cent. in weight. Counting the 70,000 tons of garbage as 15 per cent. of the total waste, then 10 per cent. for the rubbish would mean approximately 45,000 tons of rubbish for St. Louis per year. If the salable material is worth $1.44 per ton, and the steam resulting from the non-salable but combustible rubbish is worth $1.26 per ton, then this city should derive from its sale and combustion a revenue approximately $120,000. From this, of course, should be subtracted the cost of operating the plant. The Forty-seventh street plant in New York costs only 56 cents per ton of rubbish disposed of. In order to be conservative, count $1 per ton for burning, maintenance repairs, etc., and $1.70 per ton as a safe return to the city, then St. Louis should receive a revenue of not less than $76,500 from the collected rubbish, which would almost pay for the cost of collecting it.

Ashes, which compose between 65 per cent. and 75 per cent. of the city's waste, or between 400 and 600 tons per 1,000 population annually, are useful chiefly for filling purposes. In St. Louis, where soft coal is so universally used, the ash is of little value for any other purpose. Your committee, then, would recommend that the ashes of the city, amounting to some 340,000 tons annually, be collected by the city in covered ash wagons, delivered to the ash cars at the receiving station, and hauled over the tracks to the dumps provided by the city or by contractors.

Concerning street sweepings there is considerable difference of opinion as to its value as a fertilizer, and until there is a market for it the city can temporarily dispose of it with the ashes without seriously menacing the health of any section of the city, or burn it in the rubbish destructor suggested above, or arrange for its disposal together with the barn litter.

Barn litter is now being satisfactorily collected and disposed of by the railroad companies, which are competing strongly with the barn owners for it. The railroad companies haul it to the farmers outside the city, who purchase it at a price which warrants the company in hauling this refuse. That which is not disposed of by them because of the amount of straw or sawdust mixed with it, could easily be burned in the rubbish destructor suggested above.

With regard to the tenth item in the recommendations: The following table has been compiled from the most reliable data found advisable to show the cost of the present unsanitary and expensive method of garbage collection and disposal, and the comparative cost of collection and disposal under the two processes—incineration and reduction.

1. Amount of garbage collected for twelve months (based upon figures for months of April to September), 70,000 tons.	
2. Cost of collection (at $1.67 per ton, present actual rate)	$116,900
3. Cost of disposal (at $1 per ton, present actual rate)	70,000
4. Total present annual cost for handling garbage	$186,900

Estimated total amount of municipal waste for St. Louis, figures based upon statistics from American cities and estimates by experienced sanitary engineers:

(a) Garbage, 15 per cent. of total waste, 70,000 tons annually.
(b) Rubbish, 10 per cent. of total waste, 46,660 tons annually.
(c) Ashes, 75 per cent. of total waste, 349,950 tons annually.
(d) Total annual waste of St. Louis, 466,610 tons.

Collection and disposal by incineration.

(a) Construction of plants:

1. Cost of five (80 tons daily capacity) incinerators	$150,000
2. Cost of land (five lots) $8,000 each	40,000
Total cost of construction	$190,000

(b) Cost of collection and disposal of rubbish:

1. Cost of collecting 116,660 tons at $1 per ton	$116,660
2. Cost of burning 116,660 tons at 40 cents per ton	46,640

3.	4 per cent. interest on investment of $190,000	7,600
4.	10 per cent. depreciation on $150,000	15,000
	Total cost for collection and disposal by incineration	$185,900

Collection and disposal by reduction by separating waste, reducing garbage and burning rubbish:

(A)	Garbage—	
1.	Construction of plant:	
(a)	Cost of one (200-ton capacity) reduction plant	$200,000
(b)	Cost of five receiving stations	75,000
(c)	Cost of land for receiving stations and plants	25,000
	Total cost	$300,000
2.	Collection and disposal of garbage:	
(a)	Cost of collecting 70,000 tons at $1.75 per ton	$122,500
(b)	Cost of reducing 70,000 tons at $1.75 per ton	122,500
(c)	4 per cent. interest on the investment ($300,000)	12,000
(d)	10 per cent. depreciation of property ($275,000)	27,500
	Total cost	$284,500
3.	Value of by-products:	
(a)	From 70,000 tons at $3 per ton	$210,000
(b)	Actual cost—collection and disposal of garbage	74,500
(c)	Collection and reduction of garbage	$ 74,500
(B)	Rubbish—	
1.	Construction of plant:	
(a)	Construction of rubbish destructor (150 ton c'p'city)	$ 60,000
(b)	Cost of land	10,000
	Total cost for construction	$ 70,000
2.	Collection and disposal:	
(a)	Collection of 46,660 tons rubbish, $1.75 per ton	$ 81,655
(b)	4 per cent. interest on investment ($70,000)	2,800
(c)	10 per cent. depreciation of property ($60,000)	6,000
	Total cost for collection and disposal	$ 90,455
(d)	Value of salable material and steam, $1.50 per ton in excess of cost of disposal	69,990
(C)	Actual cost of collection and disposal of rubbish	$ 11,665
(D)	Total cost of collecting and disposing of garbage and rubbish by reduction	$ 86,165

If these estimates, which are based upon the experiences of other cities, be true, then St. Louis can collect and dispose of her garbage by the reduction process and her rubbish by burning for $100,000 less than by attempting to dispose of it collectively by the incinerating process within the city limits. The cost of handling the ashes would be practically the same under either system.

In all these investigations we have assumed that, whatever process is adopted, it should be placed under municipal control. If the disposal (not the collection) of the waste can be more economically and efficiently done by contract, then the franchise should provide for purchase of the plants by the municipality whenever the city is in a position to assume control. No private company can safely be given a sufficiently long-term franchise to justify it in erecting a first-class plant or plants without a guarantee that when the city decides to dispose of its own waste the company will receive just compensation for its plant. But under no circumstances should the city contract for the collection of its waste. A private company will not be so solicitous of the comfort and health of the citizens as will the municipality. The collection of the garbage affects so directly the individual citizen that it can no more be safely intrusted to a private corporation than can the control of the sewage system.

A complete municipal system for collecting and disposing of the waste of this city is a practical scheme which is at present unhampered by any old ordinances or contracts. The city authorities have a free hand in this matter. No system, apparatus or process of treatment should be considered which will not give the city immunity from the nuisances which characterized the old regime and which will not guarantee the public a perfectly sanitary, permanent and economical solution of this important problem.

Mr. Bayles makes the following points in his report:

There is now under consideration by the Municipal Assembly of St. Louis an ordinance, prepared by the Board of Public Improvements, after exhaustive study of the problem of refuse disposal in the United States, providing for the erection and operation of a municipal incinerating plant. This plant, it is recommended, shall be constructed according to plans and specifications now on file in the office of the Board of Public Improvements. The plans provide for an incinerator which shall be able to burn completely 150 tons of garbage and other waste per day. Other furnaces of the same type as those provided for in the plans have been operated in Minneapolis, Atlanta and other cities, and one is now being constructed in Los Angeles.

The point to be discussed, therefore, is whether or not the type of final disposition offered by this furnace is better and more economical than any other that can be procured for St. Louis.

The alternative are (1) some form of reduction process, such as New York, Boston, Baltimore, Washington, Cleveland, Columbus, Detroit, Syracuse and other cities use, or (2) some other type of incinerator or crematory as used in Montreal, Milwaukee, Trenton, Youngstown, O., and other cities. I do not give serious consideration to the alternative of land tipping or hog feeding, as now practiced on Chesley Island. Everyone agrees that this method is unsanitary and unsatisfactory and should be done away with as soon as possible.

One feature common to all reduction plants of which I have any knowledge is that they are inevitably creative of so serious a nuisance that they must be located many miles from the natural center of collection. In Syracuse, for example, the municipal collection corps has to haul the garbage direct to the plant, as no relay system is provided, at a cost to the city of $2.60 per ton. It has been shown in Cleveland, the only city which has availed itself of the purchase option usually included in garbage contracts, that a reduction plant can be made to give returns slightly in excess of the costs directly chargeable to operation.

In another paper Mr. Bayles analyzes the report of the Cleveland reduction plant referred to in the committee report

above, and shows that the net profit of operation is $507.98 for the six months of the report. This charges the plant with 10 per cent. depreciation on its cost of $30,088.50, but does not charge interest on this cost nor any profit such as would be expected by a private company.

It has been said by one eminent engineer that "reduction is always a nuisance, cremation usually." That this is true has been proved by such plants of both kinds as I have visited. One of the arguments sometimes advanced in favor of reduction is the fact that picking privileges for the rubbish can be profitably leased by the city. I have on several occasions committed myself to the assertion that such a practice costs any city more, indirectly, through the dissemination of tuberculosis and other contagious diseases than it can return in direct payment from a contractor.

It is folly to attempt to burn pure kitchen and table refuse without the admixture of the dryer and more combustible components which are present in the waste of every city. That this can be done is no doubt true, but that it can be done economically I have never seen demonstrated. Very few cities have attempted to burn this garbage, swill or slops without more or less admixture of what is commonly known as rubbish or combustible refuse. Bridgeport, Conn., made the attempt, and it cost about $1.11 per ton for operation and maintenance. The plant has been abandoned. Atlantic City, N. J., tried it and gave it up after some years of operation at a cost close to $1.50 per ton. Lancaster, Pa., tried it and gave it up after operating at a cost of over $2 per ton. A plant in Plainfield, N. J., was an unqualified failure. Milwaukee, Wis., has been paying as much as $1.87 per ton to operate and maintain a plant, which is now closed for the winter for repairs. Each of these attempts has been with a different type of furnace.

The incineration of mixed refuse, by which I mean all the waste discarded by houses and shops, usually excepting ashes and street sweepings, has been and can be done at a cost far below that of burning only organic waste. Youngstown, O., has what is perhaps the most carefully operated refuse crematory of its type. Here the cost of operation and maintenance has been kept as low as 35 cents per ton. There is a considerable amount of dry rubbish in the waste burned. This low cost has not been equaled in any other city, so far as I know, using the same type of furnace. The maximum is reached by the plant in Richmond borrough, New York city, where the cost of operating and maintaining a furnace of this type amounts to about $3 per ton.

Minneapolis has the oldest existent incinerator of the type that the Board of Public Improvements has decided on as the best available. This plant was operated in 1904 at a cost of 38 cents per ton. The figures for 1905 are not yet available, but I was told by Dr. P. M. Hall, the commissioner of health, that the cost would probably not exceed 31 to 32 cents. A month or two ago the wooden building and runway of this plant were destroyed by fire. Up to that time, during nearly five years of daily operation, less than $20 had been spent in repairs to the plant.

Atlanta, Ga., has the most recent large plant of this type, and the only one comparable in size to what St. Louis would need. Here the incinerator is only a few hundred yards from the new Union Depot and the heart of the business district. The cost of operation from the 1st of February to the 1st of July was only 14 cents per ton. During July, the height of the melon and fruit season, it went up to 30 cents, as about two and a half cords of wood had to be used daily to assist the combustion of the wet stuff. During August the cost was only 20 cents, and for the balance of the fall and winter it was not expected to exceed 15 cents. This would make the average for the first year's operation between 16 and 17 cents per ton of refuse burned to dry ash. I know of no other furnace that has given results comparable to this record.

Reduction originated in Vienna, and was tried in several European cities. I know of no reduction plant now in successful operation abroad. That England has over two hundred incinerators or destructors in active operation proves, not a mysterious difference in refuse composition, but that England, as a whole, has a much more advanced realization than this country of the value of fire as a means of making waste permanently harmless.

The ordinance proposes making a contract binding the contractor to operate the plant for three hundred working days, with a forfeiture in case the cost exceeds 40 cents per ton and a bonus in case it is below 35 cents.

Let us suppose for a moment that another incinerator is offered guaranteeing 50 cents per ton, but at a lower first cost. The difference of 10 cents per ton would amount in one year, on the basis of 70,000 tons burned, to $7,000. Supposing that the city issues 4½ per cent. bonds to erect an incinerator. Seven thousand dollars would represent the interest, at this rate, on an investment of $155,155.56. Therefore the plant operating at 40 cents could cost the city that much more to build and the city stand even. St. Louis can well afford to pay the proposed bonus for any reduction in cost below 35 cents.

The present practice is to use ashes for land filling, to throw into the river all material that will float, and to carry the remainder on scows to Chesley Island. Of these three classes of waste the city collects only the last. In planning for an incinerator to burn mixed refuse it is not necessary, however desirable it may be, for the city to undertake the collection of more than the one class of waste it now handles. The only change necessary would be an ordinance providing that all combustible waste, or the class now thrown into the river, shall be carted to the incinerator rather than to the river front. This would involve no additional expense to private parties handling the waste, provided some reasonably central location is selected for the plant. Such a site has been proposed. There should be no possible objection to this location, as the proposed incinerator would not be creative of nuisance.

PROBLEMS OF ADMINISTRATION

Indiana Coal Rates—Low Bridge a Nuisance—Los Angeles Municipal Art Commission—Engineering Contracts—Parks of the World—Indianapolis Gas—Berlin Street Railways—Conference of Municipal Accountants.

Indiana Coal Rates.

A decision on coal rates has just been rendered, which in effect justifies a discrimination in coal rates. It is, apparently, based on a common-sense view of the equities and necessities of the case, rather than on a strict interpretation of the law.

Finding that an increase in the freight rates on Indiana coal would not only ruin the manufacturing industries in the gas belt, but would also prove disastrous to the mining interests of the State, the Indiana Railroad Commission has decided that the three rates of coal from the Indiana mines to the cities of the gas belt, now in force, do not constitute a discrimination within the meaning of the law, and will be allowed to remain. The commissioners base their opinion upon the principle that the manufacturer, who receives a 60-cent rate a ton on coal, is not in the same class as the private consumer, who is required to pay an 85-cent rate; this difference being due to the fact that the manufacturer sends a great deal of out-bound freight from his factory, and this to an extent reimburses the railroad company for any loss that may have accrued to it owing to a coal rate below cost. The private consumer, it is claimed, does not ship out any product; hence, on coal shipments to him, the railroad companies must make a profit. The Indiana law provides that carrying companies must charge every shipper the same "for doing a like and contemporaneous service in the transportation of a like kind of traffic under similar circumstances and conditions."

Under the complaint the question arose as to whether or not, with this provision of the law in mind, a carrier can lawfully make a lower rate on coal to manufacturers who produce something for him to carry out, than for domestic consumption or for steam power for interurban and electric light plants that provide no outgoing business. The Indiana commission answers in the affirmative, and decides that the 60-cent rate to manufacturers, 75-cent rate for the steam-power user and the 85-cent rate to the domestic consumer, will prevail.

This is the most important decision the commission has made, affecting as it does the manufacturers of the gas belt, who threatened to dismantle their plants if the rate was raised; and also the output of coal from the mines.

Union Bridge Company's Low Bridge Must Come Out.

The United States court at Pittsburg, Pa., decided that the Union Bridge Company is maintaining a nuisance in its low bridge over the Allegheny and must remove it to avoid further obstruction of navigation. The removal of the bridge will open the Allegheny for steamboat navigation.

Report of the Municipal Art Commission of Los Angeles.

The municipal art commission has just filed its report with the city clerk. In several particulars this report is noteworthy, and its suggestions can at once be adopted, with the necessity of considering opportunity and expense required in dealing with such problems as an art gallery, a library, a museum and the like. In the general details of the city beautiful these three buildings figure largely, but there are smaller, less expensive problems which are just as important in evolving a well-rounded whole, and the closest attention should be given them.

The commission recommends more attention to the beautiful in the erection of bridges and approaches thereto. In some cities bridges are made monumental in effect and grand in aspect, without hampering their utility or increasing their cost. Here the bridges are as ugly as the mind of man can fashion them. A decided reform is needed in this respect.

Then, the treatment of vacant lots; usually these are utterly neglected. In a climate such as this every vacant piece of ground in the city could and should become a perpetual flower garden. The cost would be almost nothing. Think of the wonderfully beautiful result—think of the effect on visitors.

Los Angeles streets, again, need attention, not more in the way of paving than in the handling of the traffic. This is now absolutely unregulated, and congested all the time. The hitching in the business centre, keeping to the right, making proper turns at crossings—all these things add no little to the beauty of a city, and come under this head.

Engineering Contracts.

Mr. J. A. L. Waddell has printed for distribution to the students who heard him and to others a lecture on "Engineering Contracts," which he delivered last year at several technical schools. This lecture continues into the contract stage a previous lecture on specifications. He says, in beginning:

The essential elements of any contract, according to Mr. John Cassan Wait, the noted authority on "Engineering and Architectural Jurisprudence," are as follows:

1. Two parties with capacity to contract.
2. A lawful consideration—a something in exchange for its legal equivalent, a *quid pro quo*.
3. A lawful subject matter, whether it be a promise, an act or a material object.
4. Mutuality—a mutual assent, a mutual understanding, a meeting of the minds of the parties.

Without these four elements no contract is binding in law.

The essentials of a well-drawn contract that comes within the province of the engineer, however, are as follows:

1. A proper and customary form.
2. A full and correct description of all parties to the agreement.
3. A thorough and complete preamble.
4. A statement of when and under what conditions the contract is to become operative.
5. The limit, if any, for duration of contract.
6. An exhaustive statement of what each party to the contract binds himself, his executors, administrators, successors or assigns to do or to refrain from doing.
7. A clearly defined enunciation of the consideration which each party is to receive. This is the essential *raison d'etre* of the instrument.
8. The forecasting of all possible eventualities that would materially affect the agreement, and a full statement of everything that is to be done in case of each eventuality.
9. Penalties for failure to compiy with the various terms of the agreement.
10. Provision for possible cancellation of contract.
11. Provision for settlement of all business relations covered by the contract or resulting therefrom in case of cancellation, taking into account all possible important eventualities.
12. Mention of the place where the agreement is drawn or of the place where it is to be put in force, so as to show the State under the laws of which the validity of the contract is to be determined should suit be necessary to enforce it.
13. Methods of payments, if any are to be made.
14. Provision for extra compensation and the limitations connected therewith.
15. Provision for possible changes in contract.
16. Provision for transfer of the contract or for sub-letting.
17. Provision for settlement of disputes.
18. Provision for satisfactory and sufficient bond, if any be needed.
19. Provision for defense of lawsuits, if such provision be necessary.
20. Definition of names used in contract, such as "engineer," "company," "contractor" or "trustee."
21. Dating of contract.
22. Proper signatures with the necessary seals, if the latter be required.
23. Witnesses to the signatures or execution before a notary public.

Mr. Waddell then takes up in detail each of the above divisions and calls attention to the opportunities for omissions and uncertainties. The form of contract which he uses as a model is one for the construction of bridge substructures on the basis of cost plus a fixed percentage of profit. He calls attention to the fact that this class of contracts requires much more work of the engineers, and that their fees should be increased on this account.

Another form of contract given is one for the promotion and development of an engineering enterprise. He describes the conditions as follows:

Contracts looking to the development of large enterprises are not uncommon, but the attendant conditions are generally rather vague and uncertain; hence the drafting of a proper agreement between the various parties concerned is quite a difficult matter.

Let us assume that there is a project on foot to build in Colorado a large dam across Lonetree gulch for the double purpose of irrigating the lands below the site and of developing electric power to be transmitted to Denver, and that a company named the Lonetree Gulch Development Company has been duly organized under the laws of the State of Colorado by John Smith and Arthur Jones, real estate brokers of Denver, for the purpose of consummating the enterprise. Let us assume also that these men, in doing the preliminary work necessary to secure the charter, after spending $4,000, have exhausted all of their resources, and that, in order to bring the project into proper shape to present to financiers, considerable expensive engineering work is essential. On this account they have gone to Wallace & Henderson, consulting engineers, of Kansas City, Mo., who make a specialty of engineering large enterprises, and requested their assistance. These engineers have called in Green & Robinson, electrical engineers, also of Kansas City; Davidson & Osgood, masonry contractors, of Chicago, and Holman & Curtis, grading contractors, of Denver, to share with them the expense of doing all the preliminary work, which they estimate will cost $6,000 in actual cash.

with no allowance for personal engineering services.

The original promoters have agreed to deliver to the engineering and contracting firms 80 per cent. of their entire holdings in the enterprise, in compensation for the engineering work necessary to prepare a presentation of the scheme so thoroughly drawn that it will receive due consideration from capitalists. The two contracting firms have agreed to subscribe $6,000 each to the general fund. The two engineering firms are to receive $3,000 each as compensation in full for their cash outlay, and are to devote their time and attention to the preliminary work continuously till its completion.

It is understood that the Lonetree Development Company has organized and has held sufficient meetings to enable it to secure from the State of Colorado the charter for constructing the dam, irrigation system and power plant, but that no stock has been issued, only enough having been subscribed for to qualify the board of directors. The promoters value their charter and the recorded results of the work that they have done at $15,000, but are willing to dispose of 80 per cent. of their entire holdings for a preliminary cash payment of $4,000, and $8,000 to be paid to them by the two contracting firms and the two engineering firms jointly immediately after the enterprise is finnaced and compensation for their past and future work is assured.

It is understood also that, as the Lonetree Gulch Development Company's charter will expire in about six months, the original promoters are to have its privileges extended by the State Legislature for another three years, and that this must be done before the first payment of $4,000 on account will be made by the purchasers.

The 80 per cent. of their holdings that the promoters sell is to be divided equally among the four buyers, so that each engineering company, each contracting company and the original promoting company shall hold 20 per cent. of the capital stock when it is distributed, which will be after the preliminary engineering work is done and before the financiers are approached.

After paying the promoters $4,000 on account and the engineers $6,000 to reimburse them for their cash expenditures there will be left $2,000 out of the $12,000 subscribed by the two contractors. This balance is to be held by the consulting engineers to defray traveling and other expenses incident to the financing of the project after the preliminary engineering work and estimates are completed.

It is further understood that the bargain made with the financiers is to be conditioned on Wallace & Henderson being retained as principal engineers of the enterprise, with Green & Robinson as consulting electrical engineers, and that the total compensation for engineering is to be not less than 5 per cent. of the entire cost of the work, including right-of-way and all other expenses connected with the consummation of the enterprise and completion of the construction, which fee is to be divided between the two firms in the ratio of the contract prices of the portions of the construction under their respective jurisdictions. It is also conditioned on the understanding that the contract for the masonry dam and for the construction required for power development and transmission is to be given to Davidson & Osgood, and that for the irrigation works and any other construction that there may be to Holman & Curtis, at schedule rates determined by the consulting engineers on the basis of estimated actual cost plus 20 per cent. for profit.

It is understood that in dealing with the financiers the latter will demand a large portion of the capital stock, and that the exact amount thereof which they are to receive will be settled by mutual agreement between the financiers on one side and the five interested parties on the other, and that the decision of a majority of the five in respect to this and all other matters in controversy shall govern. After the amount of stock to be relinquished is determined each of the five equal holders of the entire stock shall relinquish the percentage of his holdings that has been agreed upon.

The forms of contract covering the case is then given in full, first one between the original owners of the claims and the engineers; second, one between the promoters, in this case the engineers also, and the capitalists supplying the money for the construction. These forms have been carefully worked out and may be accepted as safe guides.

Another contract, concerning which there has heretofore been but little information, is given in the form of an agreement of partnership between two engineers, one evidently of prominence and the other of less experience and standing.

The Parks of the World.

Paris was formerly supposed to embrace in its park system the largest and most beautiful area devoted to promenades, public gardens and parks of any city in the world. There was a period, indeed, when this was true, and the magnificence of its park system was well described and pictured by Mr. William Robinson in a work which has been the admiration of all lovers of park beauty and public pleasure grounds for the past thirty years.

At the present time, however, Paris ranks third in the great cities of the world in the extent of area devoted to park purposes, being exceeded by London and Boston. But four cities in the world have a park area embracing over 10,000 acres each. They are: Berlin, 11,980 acres; Paris, 17,943 acres; London, 19,000 acres; Boston, 19,032 acres. Of the cities in this country, in Great Britain and on the continent of Europe there are twenty-four whose park area embraces 1,000 acres and over each. Nineteen of these cities are in the United States, three in Great Britain and two in Europe.

In our own country the city having the second largest park area is New York, with 6,900 acres. Other American cities with park areas of very respectable proportions are: Philadelphia, 4,044 acres; Los Angeles, 3,720 acres; Washington, 3,597 acres; San Francisco, 2,804

acres; while on the continent the cities 2,183 acres; Kansas City, 1,896 acres; Minneapolis, 1,553 acres; Cleveland, 1,438 acres; Louisville, 1,370 acres; Detroit, 1,284 acres; Baltimore, 1,284 acres; Indianapolis, 1,259 acres; St. Paul, 1,204 acres; Hartford, 1,154 acres; Columbus, 1,108 acres; New Haven, 1,100 acres, and Buffalo, 1,049 acres.

English cities of quite extensive park systems are: Liverpool, 1,060 acres; Cheltenham, 1,590 acres; Dublin, 1,760 acres; while on the continent the cities having the largest park reservations are: Munich, 1,300 acres; Vienna, 4,270 acres.

The Metropolitan park system of Boston embraces the largest area, containing parks, boulevards, public gardens, pleasuse grounds and children's gardens, of any city in the world, the entire system being within a radius of twelve miles from the State House. Beginning with its historic common, one of the earliest public parks in this country, the area has extended until now it embraces the magnificent area of 19,032 acres. Dating from 1728, the common annexed the public garden in 1837 and has gradually absorbed other reservations until it now embraces its truly magnificent area. This splendid system is really the creation of the late Frederic Law Olmsted and the late Charles Eliot, the son of President Eliot, of Harvard, who died a few years since at the early age of thirty-two years. Most appropriately one of the parks of Boston bears the name of Olmsted Park, while a memorial bridge and magnificent drive in Franklin Park bear the name of Eliot as a monument to the brilliant young landscape architect, who was "a lover of nature and of his kind, who trained himself for a new profession, practiced it happily and through it wrought much good."

One of the great drives in the Boston parks is fifteen miles in length, reaching from the public garden through the Back Bay Fenway to Jamaica pond, West Roxbury, Milton and the Blue Hills. It is said to be a most magnificent drive, embracing a wider extent of varied and picturesque natural beauty than can be found in any city in the world. There may be smaller areas of finer growth or kept in a more perfect manner, but for extent, varied beauty and good care combined no park drive in any city in the world can compare with it.

While the above enumerates the world cities of largest park areas, it must not be forgotten that American, English and continental cities of the secondary and smaller classes, even towns of very limited extent and small population, now have their parks, pleasure grounds and children's play gardens. Our country numbers these by the hundreds, and one of the better indications of the true public spirit of the day is that old towns are securing them and the newer towns providing them as fast as possible. We believe that in the future great gifts of the rich benevolent will be given to providing and maintaining public parks for the enjoyment, recreation and health of the people.

The Indianapolis Citizens' Gas Movement.

The United States Circuit Court of Appeals, at Chicago, handed down a decision February 6 in the suit of Quinby vs. The City of Indianapolis. The right of the city of Indianapolis to purchase, at an appraised price, the property, including the manufacturing plants, mains and pipe lines of the Consumers' Gas Trust Company, was involved. The decision of the Court of Appeals involves two important points, as follows:

1. That the option clause in the ordinance of 1887, giving the city the right to purchase, after ten years, the property of the Consumers' Gas Trust Co. at an appraised value, is valid and that the city has the power to exercise such right.

2. That the city, having such option, has the right to assign the same.

This suit was an obstruction to the negotiations by which the city sought to transfer its rights in this option to the Citizens' Gas Co. The Citizens' Gas Co. had purchased for $25 an option on the city's right to buy the plant at an appraised value. The price to be paid by the new company is $100, and the option was taken in the event that the court would sustain the city in the enforcement of the option clause in the ordinance.

By this decision the property, consisting of the mains and pipe lines connecting 14,000 houses in the central part of the city, will pass into the control of the Citizens' Gas Co., a corporation now being organized to supply fuel gas in Indianpolis at 60 cents per thousand feet. When the records are completed the gas company will complete its work of organization, pay the city the price of the original option, take over the property of the Consumers' Gas Trust Co. at a price which will be fixed by three appraisers and begin the fulfillment of the promise of fuel gas at 60 cents a thousand feet.

The decision was handed down by Judge William H. Seaman, with a concurring opinion by Judge Peter S. Grosscup.

Municipal Ownership of Street Railways Proposed for Berlin.

At a conference of the Berlin municipal authorities with the municipal officers of eight suburban towns, including Charlottenburg, January 29, it was resolved to take steps to acquire the Berlin Street Railway Co., which has practically the monopoly of the street railroads of Berlin and its suburbs, and to operate the lines on the joint account of the municipalities. The company has a capital of $25,000,000.

Conference of Municipal Accounting Officers.

The Census Bureau called a conference of controllers, auditors, treasurers and other city officials interested in the uniform classification of municipal accounts and municipal statistics, at Washington, D. C., February 13 and 14. Director S. N. D. North pointed out the faults of the present financial system, saying:

The most prolific source of municipal graft, its securest hiding place, its most effective instrument in seeking immunity, is the chaos which exists in the classification of municipal accounts and the absence of uniformity in municipal bookkeeping.

We have in the United States 175 cities with a population of 30,000 or more, and they are resting today under the stigma of being the most extravagantly and inefficiently governed. The financial officers of these cities annually collect and disburse a sum exceeding $765,000,000, or more than the annual cost of all the State governments, and more than the annual cost of maintaining the national Government.

These cities have a bonded or funded indebtedness equaling $1,500,578,000, after deducting for sinking fund assets—an indebtedness greater than that of the United States. This municipal indebtedness is increasing at an enormous rate, probably not less than $150,000,000 a year.

He also referred to the question of municipal ownership of public utilities and said that definite standards by which the comparative results of private and public management can be obtained are impossible in the existing chaos of municipal accounting.

The first meeting of this kind was held in Washington in November, 1903, and proved very helpful in unifying the classification of accounts, thus permitting a comparison of the financial statistics of the different cities. The success of this former meeting induced the advisory committee appointed at that time to request the Census Bureau to call a second conference.

ROADS AND PAVEMENTS

Asphalt Pavements of Manhattan—Road Improvement in Paraguay—Paving Brick Testing and Inspection—Cement Trade.

The Asphalt Pavements of Manhattan.

The committee on thoroughfares of the Municipal Art Society of New York has presented a report upon the asphalt pavements of Manhattan, from which the following is abstracted:

The following table will show the amounts in square yards and mileage of the different kinds of pavements.

	Square Yards.	Miles.
Oblong granite	2,381,357.11	104.82
Square granite	273,725.34	4.90
Oblong trap	633,115.43	27.37
Belgian trap	496,924.18	3.14
Sheet asphalt	4,733,297.18	235.95
Block asphalt	437,050.51	22.47
Cobble	3,304.88	.79
Wood Block	27,089.50	1.51
Macadam	901,555.99	17.50
	9,837,420.12	418.55

So many complaints have been made about the present condition of asphalt streets it was thought advisable to first investigate this kind of pavement.

It was found that the price paid for asphalt pavements has decreased in the last few years, although at the expense of quality. The following table shows the range of prices and the periods of guarantee from 1897 to 1906:

Years.	Average Price.	Maintenance Guarantee.
1897	$3.18	15 years
1898	3.23	15 years
1899	None contracted for	—
1900	3.69	15 years
1901	3.35	10 years
1902	1.55	5 years
1903	1.92	5 years
1904	2.13	5 years
1905	2.13	5 years

At first sight this reduction of price might seem favorable, but as a matter of fact, when all things are considered, it is not as good as the higher-priced pave-

ment. For instance, the period of guarantee has been reduced from ten and fifteen years to five years, which, under the lax system of inspection by the borough authorities, has resulted in a poorly laid pavement and at the city's loss. Whereas the old specifications called for a concrete base of 6 to 8 inches, the contractor is allowed to cut it down to 4 and 5 inches. In many instances where pavements have been actually measured the contractor has been found to give short measure. What is known as the binder course, which is laid on top of the concrete base, is not as thick, nor is as good material used as formerly. The top or wearing surface has also been slighted, so that the city has not received the full measure called for by the specifications.

Extracts are made from the report of the Commissioners of Accounts upon asphalt specifications, which is reviewed elsewhere in this number of MUNICIPAL ENGINEERING and the report proceeds as follows:

The fact that the asphalt pavements alone in the borough of Manhattan have cost the city about sixteen million dollars is sufficient reason for their proper maintenance. That they are not properly cared for will be sufficiently shown by a few instances. For example, the section of Eighth avenue from Thirty-fourth to Fiftieth street which has been under a maintenance contract for the past ten years, expiring December 31, 1905, shows that it had been sadly neglected by the borough officials. The original pavement was poorly laid and constructed of poor material. The pavement cost the city 14 cents per square yard per year, for ten years, and would have allowed the contractor an excellent profit on his work if he had resurfaced the entire area in that period. If the contractor had been obliged to do his work properly by the city authorities it would have left the street in good condition for five years' more of wear.

The report goes into details regarding the defects in this pavement and also in the pavement on First avenue from Twentieth to One Hundred and Tenth street and closes by citing the contract provisions under which good work can be required of contractors and adds the following pertinent paragraphs:

The foregoing statements showing the present condition of this pavement furnish sufficient evidence of dereliction on the part of the borough officials.

Inasmuch as your committee has found the asphalt pavements generally in such imperfect condition it respectfully recommends that a copy of this report be sent to Borough President Ahearn.

Road Improvement to Begin in Paraguay.

Consul Ruffin, stationed at Asuncion, Paraguay, in a recent report stated that "The president has promulgated a law passed by Congress on the improvement of the public roads. An office is created called 'dictator-general of public roads and ways of communication,' whose duty will be to open up canals and place roadways in good repair. This new step on the part of the government will greatly facilitate communication with the rural districts, which up to the present can not reach the city markets to advantage, the roads being in such a bad state."

This new law ought to mean the sale of American road-making machinery in Paraguay.

Paving Brick Testing and Inspection.*

By Prof. Arthur N. Talbot, University of Illinois, Champaign, Ill.

The feeling is sometimes apparent, possibly not openly stated, but at least implied in the attitude of the parties, that the engineer in charge of public improvements and the contractor doing the work are necessarily natural enemies and that the contractor considers the engineer as something like a necessary evil which ought to be abated or at least to be mitigated as far as possible. The writer does not believe this is a proper view of the situation and thinks that a fair consideration of the matter would serve to clear up many misunderstandings. It is in this spirit that the following remarks are given.

Most specifications for materials set forth qualities of materials to be furnished by the producer to the consumer. In the case of brick pavements the producer—*i. e.*, the manufacturer and the contractor—and the consumer, who is the municipality and property owner as represented by the municipal administrative officers, are to use certain requirements to define the material to be put into the pavement. Some of the purposes of these requirements and tests may be expressed as follows:

1. To make a basis or definition of what is wanted and what is to be furnished. This is the commonly accepted purpose of such requirements and tests.

2. To enable the city to secure material which will be as serviceable as other material which has passed the requirements and which has stood the test of traffic and time. This makes, in a sense, the tests a guaranty of quality.

3. To enable comparisons to be made between the products offered. It is quite possible that tests may show that a given brick is above the requirements, or that a slight difference in price is made up many times by the superior quality of the article.

4. To improve the general quality of the product put on the market. One need

*A paper before the Illinois Clayworkers' Association.

instance only structural steel and paints and oils to show improvement in quality, following carefully made requirements and tests to show the beneficial influence of adequate inspection and tests.

5. To safeguard the interests of the public and of the taxpayer. The Illinois law requires, and rightly, too, that the nature and quality of the improvement shall be explicitly stated, and evidently intends that the taxpayer may be able to determine (1) what the improvement is to be and (2) whether it is being put in as described.

6. To enable control to be exercised over incapable or dishonest contractors or city officials and to restrain careless or inefficient employes or men who may have a mistaken notion of what their employer's interests are.

7. To educate producer, consumer and their agents in the qualities needed in paving brick—from the manufacturer and the contractor and their employes to the mayor, the engineer and the inspector.

It is appreciated that the items enumerated overlap one another somewhat, and that not all of them are in evidence on every piece of work. Included in them, however, are such important results as giving the opportunity for all bids to be made on the same basis and for the bidder to fix his price according to the quality of the article wanted and to facilitate fair competition.

It is not easy to formulate a statement of the qualities for paving brick, but in a general way it may be said that the following properties are wanted: 1. Toughness and hardness. 2. Uniformity of quality throughout a given lot of brick. 3. Homogeneity of structure and freedom from laminations. 4. Weather-resisting quality. 5. Regularity in form and size. It will be noticed that uniformity of quality has been put second. It is hardly secondary to toughness and hardness, and it seems to the writer that its importance is not generally sufficiently recognized.

There will probably be little difference in opinion concerning what qualities are desirable in paving brick. How to define these qualities, how to make tests to determine whether the required properties are present and how to make an inspection which will extend this examination to the whole of the brick put into the pavement are problems involving many difficulties. At the outset it must be understood that such tests and inspections must, by the very nature of things, be imperfect and somewhat uncertain, and that the work will be on a different basis from the testing and inspection of steel, for example. This does not argue for the omission of such requirements and does not lessen the need for standards of acceptance other than the opinion of some one man, but the tests and inspection must be judged, keeping in mind their inherent imperfections. In selecting tests it must be borne in mind that the test is to determine some property of the brick and that the test may be far away from any actual and practical service to which the brick may be subjected in the pavement. An approach to conditions of wear in the street is desirable, since such a test will appeal to the amateur as reasonable, but this is not essential. The test of toughness in steel, for illustration, is the cold bend test (bending flat while cold) and also a specified stretch when tested to destruction, neither of which is at all similar to the conditions the metal will be subjected to. The object of tests is to determine whether the desired properties exist in the brick.

It will not be expected that this paper will go into the technical features of brick testing very deeply. Some of the principal methods will be considered and brief references made to requirements for different grades of brick.

Absorption Test.—The writer some time ago called attention to the advantage which the absorption test has for many makes of brick in giving an easy way of determining under-burned brick, and also to the fact that for many makes of brick there is so very little difference in absorptive capacity between the good brick and overburned brick that this test fails entirely in this respect. He also called attention to the fact that, while no general requirements for absorption covering all makes of brick may be made and, hence, that general limits of absorption are improper in specifications, yet, for a brick from a given yard, the absorption test may serve a useful purpose. It was also suggested that the limits of absorption may be set by extending the range a specified amount beyond the amount absorbed by samples at the time of the letting. The absorption test gives information concerning brick, but the requirements formerly current in specifications were misleading and are without value.

Crushing and Cross-Breaking Tests.—Crushing and cross-breaking tests give valuable information about paving brick and are of especial value when a study is being made of the best treatment to give a certain shale to get best results or in otherwise making comparison between bricks or methods of manufacture. As a requirement in specifications these tests are not so useful. Generally any fair paving brick will stand the usual requirements. Where facilities for making the cross-breaking tests are available this

test may well be included in the requirements, for it gives another indication of the properties of the brick. The crushing test is more difficult to make, and the information obtained in the cross-bending test throws light on the crushing strength.

The N. B. M. A. Rattler Test.—The old N. B. M. A. rattler test was an unfortunate selection. In some cases soft brick rejected at the yards gave better indications than a good quality of brick. The test was adopted without including any but high-grade brick in the investigation. The N. B. M. A. standard rattler test, adopted in 1900, is a great improvement, but even this test has its limitations. It has the merit of being simple, expeditious and inexpensive. The writer has never considered it to be an ideal test; it lacks in definiteness, uniformity and perspective. For a given make of brick there may be too little difference in results between the indifferent brick and the good article. The accidents of testing cover a wide range. The tests do not always permit a sound comparison of the merits of different brick, glazing, form, excessive impact and other causes interfering somewhat with correct conclusions. And yet the test is probably the best now available. It is evidently serviceable in helping an inspector to judge the quality of the different grades of brick which come from any yard and to help him form his judgment of their quality. It makes a reasonably good guide to settle whether brick come up to the standard imposed by an ordinance for a given improvement.

The Talbot-Jones Rattler Test.—In the so-called Talbot-Jones machine the brick are clamped around the circumference of a circle, themselves forming the drum of the machine on which the shot roll and tumble. The conditions more nearly approach the conditions of street pavement. This machine is still in the experimental stage, but it promises well. Brick taken from street pavement, where they have seen severe service, wear in this machine so that the opposite face is remarkably like that which has received the street wear. Tests with this machine require more time than it taken by the N. B. M. A. rattler. The mixture and charge of shot used and the speed and number of revolutions selected were decided upon after several series of tests had been made with different grades and different makes of brick and after studying the relative amount of chipping and abrasion under a variety of conditions and watching the action of the shot through the screen used as the head of the drum. With the present device the brick are set too far apart, they are not supported well enough laterally and the shot may, by reason of varying thickness of brick or varying shape of corners or varying degrees of smoothness of surface, be carried to different heights before tumbling, and thus give losses which are not comparable. Yet the results with different grades of brick are satisfactory, and comparisons of different makes of brick whose quality is apparent are, in general, more satisfactory than those made with results from the standard rattler. Construction is now in progress of a head and drum which will permit an adjustment of the circumference to hold an integral number of brick evenly and closely spaced, with fillers between the brick and with a device to restrain the shot from rising beyond a certain height. It is hoped that this arrangement will eliminate the imperfections found in the present machine and that tests made with the improved machine will prove satisfactory all around.

Requirements for Tests.—The values of the upper limit of rattler losses for three grades of paving brick and block, which may be termed (1) heavy traffic, (2) medium traffic, (3) light traffic, for both the N. B. M. A. standard rattler and the present Talbot-Jones rattler are for the standard rattler for the usual size block: Heavy traffic, 17 per cent.; medium traffic, 21 per cent.; light traffic, 24 per cent. For brick size: Heavy traffic, 21 per cent.; medium traffic, 25 per cent.; light traffic, 28 per cent. For the present Talbot-Jones machine the limiting values are for block: Heavy traffic, 5 per cent.; medium traffic, 7½ per cent.; light traffic, 10 per cent. For brick: Heavy traffic, 9 per cent.; medium traffic, 11 per cent.; light traffic, 14 per cent. These figures are subject to modification according to requirements of traffic and conditions of the brick, and are not to be taken as iron-clad limits.

The values shown are borne out by numerous other tests, also made in the Laboratory of Applied Mechanics of the University of Illinois, a number of them on brick which had seen service in the streets of Columbus, O., and Springfield and Champaign, Ill.

In taking up the subject of inspection of paving brick it must be admitted that inspection is generally an unsatisfactory topic to both contractor and municipality. Inspection is a difficult task, requiring skilled judgment, expert knowledge, intelligent action and ability of no mean order, as well as the qualities of tact, balance and horse sense. Men of this kind available for this purpose are rare. It is not so much that the politician desires to appoint a favored cititzen or that the residents on a street feel that one of their number will best serve their interests. The municipal administrative officer will usually gladly waive these considerations if an inspector of the ideal type can be

found. But the work for an inspector is spasmodic, the season is short and his importance in the constructive world is not yet so well established that he receives the salary of a football coach, so that we must not expect a surfeit of ideal inspectors. However, the first requisite of paving brick inspection is a level-headed and wide-awake inspector, and it is to the interest of all concerned that this class of men be developed.

Inspection involves a study of the brick put on the street. An inspector whose work came under my observation last summer selected types of brick which he found, what he thought to be soft, hard, brown, brittle, red, black or what not, and made a lot of rattler tests and absorption tests to determine the relative place of these various types and to aid his judgment in the inspection. This is a step in the right direction. It illustrates what was meant by saying that tests and requirements should be useful in educating inspector, citizen and contractor.

The difficulties of inspection are increased by the way material is loaded on cars and piled on the streets. Good and poor are mixed together indiscriminately, even when the change of quality is apparent as the wagon is loaded. Lack of uniformity is the bane of paving brick. May not the manufacturer remedy this in part, at least, and place the mediocre brick on streets which want cheap brick and selected brick on streets which are willing to pay for a serviceable article?

This leads me to another suggestion—that the brick be inspected at the yards as steel is inspected at the mills. This could be done by bureaus of inspection, which would employ expert inspectors, as is done in the case of steel inspection, and this service would be paid for by the thousand of brick inspected or yard of pavement to be put down, instead of at $1.50 a day. The bureau of inspection would be given the requirements specified for the brick in the ordinance and the contract and would certify to the quality of the brick. This inspection would not entirely relieve inspection on the street and in the pavement, for chipped, broken and otherwise defective brick would still show up, but it would make rejection of a poor lot of brick less objectionable to the producer and, if properly carried out, would, in my opinion, result in great gain for both the manufacturer and the municipality.

Altogether inspection covers a multitude of details, involves everlasting vigilance and entails patience and even temper, and the city which can get good inspection is indeed fortunate. A reputation for severe inspection is said to cause an undue increase in the bids for work, but this charge must not be accepted without consideration. Five cents a yard extra is only the cost of a year's life of a pavement on a residence street or six months' on a business street, and who will not say that the difference in quality of brick may not make five or ten years or even more difference in the life of the pavement. Surely adequate and judicious inspection pays for itself many times over.

Let the consumer define his needs; let the producer bid on this product. Consumer and producer may then adjust needs and prices according to prevailing conditions. The writer has not attempted to go into details as to how large a chip or how crooked a face is cause for rejection of the brick; he has instead touched upon the larger question of the relation between producer and consumer and their agents. Brick must continue to be the principal material for street pavement in the inland cities of Illinois. In the last decade this material has been lifting our prairie cities up out of the mud and permitting the beautifying of streets and adjoining property. Let us hope that its usefulness will be enhanced by mutually understood requirements and tests and adequate and judicious inspection.

BRICK.

Ref. No.	*Grade.*	*Loss in Stan.*	*Per Cent. Talbot-Jones.*
6	Standard	15.6	4.0
3	No. 1 brown	22.3	10.2
2	No. 1 red	24.3	9.7
4	No. 1 standard	28.4	9.8
5	No. 2 soft	31.2	15.2
1	Overburned	35.6	18.8

BLOCK.

Ref. No.	*Grade.*	*Loss in Stan.*	*Per Cent. Talbot-Jones.*
13	Standard	13.3	2.4
15	Standard	15.2	5.6
14	Granite (spring)	15.3	4.5
9	No. 1 red	16.5	5.0
17	C	17.0	8.4
10	No. 1 brown	17.8	7.6
16	Duro (Clevel'd)	20.0	5.6
11	No. 1 standard	20.6	4.2
8	Overburned	27.4	12.0
7	Underburned	30.2	13.3
12	No. 2 soft	31.2	18.1

Imports and Exports of Cement for 1905.

During the year 1905 there were imported 846,577 barrels, of 400 pounds each, of foreign cements, as compared with 1,046,403 barrels for 1904 and 2,317,950 barrels for 1903. The re-exportations for these years were 31,874 for 1905, 39,610 for 1904 and 65,981 for 1903, making the amount of foreign cements consumed

in this country 815,703 barrels for 1905, 1,006,793 for 1904 and 2,251,969 for 1903. The exports of American Portland cements for 1905 were 1,026,502 for 1904, 774,940 and for 1903, 285,463 barrels. For the first time, therefore, the United States made in 1905 more cement than was needed to supply its own demands. The rapid increase in exports should be noted, the exports in 1904 being 172 per cent. greater than in 1903 and those for 1905 being 32 per cent. greater than in 1904. The actual increase in barrels was 285,463 barrels in 1904 and 251,562 barrels in 1905. The increase in domestic consumption is far greater as yet, although, on account of the vastly larger figures the percentage of increase is smaller.

MUNICIPAL AND TECHNICAL LITERATURE

Municipal Reports—New Publications.

Municipal Reports.

Notes on Cement Testing. Additional data concerning the relation between the chemical and physical examination of Portland Cements. Report made by Otto H. Klein, Chief Engineer and Stephen F. Peckham, Chief Chemist, and transmitted to John C. Hertle and William Harman, Commissioners of Accounts and by them to Mayor George B. McClellan, New York City.

This report is the result of an investigation made to discover if possible a relation between chemical and physical examinations of Portland cements, mortars and concretes, and develops modifications of the standard methods of analyzing cements which, it is claimed, give opportunity for such a relation to appear more clearly than heretofore. The conclusions state the objections made to the processes recommended by various chemists, thus calling attention to the differences from the process of analysis recommended by the authors, which is stated in full in the report.

The office of Commissioners of Accounts has a very peculiar position in the New York city government. Some time since these two gentlemen made a report on asphalt paving, apparently with a view to improving the specifications in use in the city and permitting competition in materials at the same time that poor materials should be kept out. The office does not seem, however, to have any power to secure the adoption of its recommendations. This asphalt report was made early in 1904, and the report of the Borough of Brooklyn for that year shows low prices for asphalt pavements, the average price of 45 miles, with 2-inch wearing surface, 1-inch binder and 5-inch Portland cement concrete foundation, being $1.66 a square yard on streets without car tracks and $1.99 with, the brands of asphalt used being Venezuela, Bermudez, Alcatraz, Trinidad, Genasco and Obispo, laid by seven companies. The prices of pavements let at the end of 1904 averaged $1.41 a square yard, which was attributed to "the lively competition between the different companies."

The report of the engineer and chemist of the Commissioners of Accounts is quite fearful that some of this cheapness may be secured at the expense of quality. Part of it is secured by change in the period of the guaranty.

New Publications.

Cements, Limes and Plasters, their materials, manufacture and properties. By Edwin C. Eckel, C. E., Assistant Geologist U. S. Geological Survey; 744 pp., 165 figures, 254 tables. Cloth $6 net. New York, John Wiley & Sons.

Mr. Eckel classifies cementing materials as simple and complex, the simple materials including plasters and lime and magnesia and the complex materials including hydraulic cements and oxychlorides.

Part I is devoted to the plasters and describes the composition, distribution and excavation of gypsum, the chemistry of gypsum burning and methods of manufacture of plasters, including cost of production. It also considers in detail the composition, properties and methods of test-

ing plasters, the use of retarders and acceleration of setting and hardening, the qualities and methods of manufacture and use of flooring plasters and hard finish plasters, with a chapter of statistics of the gypsum industry in the United States.

Part II is devoted to lime. It begins with the geological formation of limestone deposits and their chemical compositions and continues with descriptions of methods of burning and of kilns employed therefor, including cost of the process and statistics of its extent. A chapter is devoted to the composition and properties of various kinds of lime, high calcium, lean, magnesian, etc., with full data regarding methods of use and results of tests of strength. Hydrated lime, its preparation and properties are fully treated, also the manufacture and properties of sand-lime bricks.

Part III is devoted to magnesia and oxy-chloride cements, magnesia bricks, sorel stone, etc.

Part IV discusses the theory of hydraulic limes and describes their manufacture and properties, including grappier cements and selenitic limes.

Part IV goes fully into the relations of natural cements to others, the composition of the various rock deposits from which natural hydraulic cements are made, the methods of quarrying, burning and grinding, with full descriptions of the machinery used, and the resulting product and its cost. It also goes into detail regarding the composition and properties of the various natural cements, including chemical compositions, weight, specific gravity, rapidity of set, tensile strength, compressive strength and modulus of elasticity. One chapter is devoted to specifications for natural cement, giving four sets and comparisons of results of tests. Another gives an excellent history of the industry, statistics and an estimate of its prospects. This is the fullest and best treatment of the subject of natural cement which has yet appeared.

Part VI is the largest in the book, taking 340 pages and goes into considerable detail of history, definitions, physical and chemical, kinds of material used, location of plants, etc. in the preliminary chapter. The various materials are considered in detail in chapters on limestone, cement rock, fresh water marls, alkali waste and blast furnace slag, clays, shales and slates, Excavating the raw materials, including cost of delivery at the mill, calculation and control of the mix, preparation of the mixture for the kiln, crushing and pulverizing machinery, stationary kilns, the rotary kiln, heat consumption and heat utilization, requisites and treatment of kiln fuels, clinker cooling, grinding and storage and use of gypsum, are subjects of chapters and all these subjects are treated in considerable detail. The details of cost of manufacture of Portland cement are thoroughly worked out in another chapter and statistics of the growth of the industry are given as taken from the United States Geological Survey reports.

There is a technical discussion of the constitution, setting properties and composition of Portland cement and a full description if its physical properties and of the methods of testing them, with a reprint of the standard instructions issued by the American Society of Civil Engineers. The last chapter of this part gives the specifications for Portland cement used on the New York State canals, those of the New York Rapid Transit subway, of the New York department of bridges, of the U. S. Engineer Corps, of the U. S. reclamation service, of the Canadian Society of Civil Engineers, of the Concrete-Steel Engineering Co., of the American Society for Testing Materials and the British standard specifications.

Part VII treats of puzzolan cements, describing and analyzing the various puzzolanic materials and the manufacture of slag cement, including a full statement of the requisites for and method of treating the slag, the composition and treatment of the lime and the composition and properties of the resulting cement, with the specifications used by the U. S. Engineer Corps. Slag bricks and slag blocks are considered in the last chapter. There is an index covering 22 pages.

As already stated Mr. Eckel has given the fullest treatment of the subject of manufacture of the various cements and plasters wh.ch has yet appeared in book form in this country and there is much in his book which it would be difficult, if not impossible, to find in print elsewhere. His position and opportunities have been used to good advantage in making his collections of data and his study of methods and results has been thorough and well directed. The book must be added to the list of those which are indispensable to one who wishes to know cements thoroughly.

ORGANIZATIONS AND INDIVIDUALS

Grand Rapids Cement Block Makers—Technical Meetings—Personal Notes.

The Grand Rapids Cement Block Makers' Association.

The Grand Rapids cement block makers have formed an association for the purpose of having the city of Grand Rapids, Mich., adopt a proper building code for cement construction, and also for the purpose of getting better concrete blocks. The association will be known as the Grand Rapids Cement Block Makers' Association. Nicholas H. Battjes was elected president and Carl M. Adams secretary of the association.

Technical Meetings.

At a convention held in Flint, Mich., January 25, the Michigan Good Roads Association was organized. About fifty delegates from eleven different counties in the State attended the meeting. Officers were elected as follows: President, W. W. Todd, Jackson; vice-president, H. W. Davis, Lapeer; secretary, Dr. Rachel J. Davison, Flint; treasurer, B. F. Ross, Ypsilanti. An executive committee and a vice-president for each county were also named. Resolutions were adopted demanding, among other things, that a just proportion in the future of the money contributed in taxes to the State and nation by farmers be returned to them for use in making good roads, and that appropriations made by the Michigan Legislature for road improvements in the State shall provide a fixed sum for each county, based on its assessed rural valuation. The resolutions also favor the adoption of the township and county systems of road building, and invite State and national agricultural associations to offer premiums for excellence in road building and the naming of country roads on the market system.

The Albany Society of Engineers was organized recently in Albany, N. Y., and officers were elected as follows: President, W. P. Creager; vice-presidents, Julius W. Pfau, Frank R. Lanagan and George F. Chism; secretary, Gordon S. Thompson; treasurer, Theron M. Ripley; librarian, George S. Stickney.

At the February meeting of the Pacific Northwest Society of Engineers, held at Seattle, Wash., February 3, Prof. C. E. Magnusson, of the University of Washington, read a paper on "Recent Development in Electrical Engineering," in which he dealt largely with the advantages of single-phase alternating current for suburban lines carrying heavy traffic. E. G. Allen, H. D. Hanford, C. A. Whipple and W. S. Wheeler discussed the paper. A. H. Dimock, secretary.

The Illuminating Engineering Society, recently formed, held a meeting at the Hotel Astor, New York city, February 13. The society's next meeting will be held March 13. E. L. Elliott, 25 Broad street, secretary.

The eighth annual convention of the League of Michigan Municipalities was held at Grand Rapids, Mich., February 20, 21 and 22. Among the papers on the programme were the following: "American Municipal Progress, Public Service," with stereopticon views, by Prof. Chas. Zueblin, of the University of Chicago; presidential address, by Mayor E. F. Sweet, of Grand Rapids; "Municipal Progress With and Without Brakes," by Alderman D. E. Heineman, of Detroit; "How to Swing the Ax," by S. A. Freshney, commissioner of public works of Grand Rapids; "Good Roads," by Mayor W. W. Todd, of Jackson; "Hints on Asphalt Paving and Repairs," by C. A. Proctor, asphalt inspector, Detroit; "The Municipalities' Interest in Constitutional Amendments," by Mayor G. P. Codd, of Detroit; "The Revision of the State Constitution," by Representative H. T. Heald, of Grand Rapids; "The Municipal League," by Mr. J. F. Bible, of Ionia; "Progress and Association," by Mayor H. Geerlings, of Holland; "Local and Interurban Railroads," by Mayor W. R. Taylor, of Kalamazoo; "The Press and Municipal Progress," by Mr. A. H. Vandenberg, of Grand Rapids; "Conscience in Municipal Affairs," by Mayor Francis Hamilton, of Ann Arbor; "Municipal Ownership of Public Utilities," by Mayor E. F. Dunne, of Chicago, Ill., and Mayor Tom Johnson, of Cleveland, O.

Personal Notes.

W. L. Hall has been elected mayor of Fort Mill, S. C.

Arthur Hooker has been appointed city engineer at Pullman, Wash.

Hon. M. B. Cullum was re-elected mayor of Duluth, Minn., February 6.

George N. Randle has been appointed city surveyor at Sacramento, Cal.

W. M. Carpenter has been appointed superintendent of water works at Geneva, N. Y.

Mr. Irving A. Bachman is president of the Standard Portland Cement Company, succeeding Mr. W. G. Henshaw.

Aaron Marsh Parkhurst, who served twice as mayor of Mountainside borough, N. J., died February 11, of heart trouble. Mr. Parkhurst was 73 years old.

John Anderson, who has served as water commissioner at Binghamton, N. Y., since 1874, died January 31.

Col. Park Woodward has been reappointed general manager of the water department at Atlanta, Ga.

R. W. Faris has been appointed chief engineer of the Twin Falls Lake and Water Company, at Salt Lake City.

W. C. Kent has been appointed general manager of the Whitehall Portland Cement Company at Philadelphia.

James Parker was appointed a member of the Board of Water Commissioners to succeed himself, for the term of three years, at Atlantic City, N. J., February 17.

Owen Woods was appointed commissioner of public works at Tacoma, Wash., February 2, to succeed William Welsh, who resigned to accept a better position.

S. F. Powell was elected mayor and A. J. Fawbush, O. R. Gillenwaters, Albert Lyons, J. B. Murrell, J. O. Phillips and A. B. Rogan aldermen, at Rogersville, Tenn., February 3.

Hon. Thomas Arkell, ex-mayor of St. Thomas, Ont., died February 2, aged 82 years, and Hon. D. M. Drake, another ex-mayor of St. Thomas, died February 1, aged 78 years.

E. Elbert Young, M. Am. Soc. C. E., has been appointed engineer and manager of the Healey Sewer Machine and Construction Company, with offices at 438 Park Row building, New York city.

Henry C. Maetzel has been appointed city engineer at Columbus, O., to succeed Julian Griggs, and Anton Ruhl has been appointed superintendent of the street-cleaning department, succeeding Sylvester Condon.

Milo R. Maltbie, one of the expert members of the public-ownership commission of the National Civic Federation, sailed for London February 10, to make arrangements for a visit of the entire commission to England in May.

The Richardson-Lovejoy Engineering Company was incorporated February 17 by W. D. Richardson, Ellis Lovejoy, A. V. Bleininger, C. P. Harrop and Gustave Hall, to conduct a consulting engineering business in Columbus, O.

Mr. James L. Bernard resigns on February 1 as sales manager of the Northampton Portland Cement Company, to assume the position of sales manager with the Alma Cement Company, with offices at Wellston, O.

David Trainer has been elected president and general manager of the Alma Cement Company, succeeding Mr. B. B. Lathbury. Mr. H. L. Shock has resigned the vice-presidency of the Empire Portland Cement Company.

George W. Cutting, Jr., formerly assistant engineer of the Metropolitan Water and Sewerage Board of Boston, has established an office at 15 Lawrence building, Waltham, Mass., for general engineering practice.

Paul Hooker, who has been connected with the public improvement work in Harrisburg, Pa., has been appointed resident engineer on the construction of a twenty-mile section of pipe for the Lynchburg (Va.) water works.

C. Brunel Parker has accepted the position of assistant superintendent of the Hackensack Water Company, at Weehawken, N. J. Mr. Parker was for several years assistant superintendent of water works at Cambridge, Mass.

J. A. Milne has resigned as comptroller of the Allis-Chalmers Company, at Milwaukee, to become manager of Allis-Chalmers-Bullock, Ltd., at Montreal. He was succeeded in Milwaukee by L. F. Bower, heretofore manager of the company's electrical works at Cincinnati.

Williams & Whitman, Inc., civil and sanitary engineers, New York city, have reorganized as Williams, Proctor & Potter, Inc., E. B. Whitman having withdrawn from the firm. The company now consists of R. B. Williams, Jr., R. F. Proctor and Clyde Potter.

J. Moreland, formerly city engineer at Knoxville, Tenn., and Joseph H. Moses have formed a partnership for general engineering work under the firm name of Moreland & Msoes.

The Alma Cement Company has decided to close its executive and sales agency offices in the Land Title building, Philadelphia, and remove the same to Wellston, O. On and after February 15 all communications should be addressed to the company at Wellston, Jackson county, Ohio.

W. W. Cunningham, formerly treasurer of the Pennsylvania Clay Company, manufacturers of vitrified fire clay paving brick, has been elected president and general manager of the company. The general offices of the Pennsylvania Clay Company have recently been removed from Rochester, Pa., to the Germania Savings Bank building, Pittsburg.

The Iowa Engineering Company, consulting engineers for municipal public works, Clinton, Ia., has removed from the Weston block to the company's own building, the Chase block, 123 Sixth avenue. Among the new features added by the company are a cement testing laboratory, a blue-printing department and a chemical laboratory.

George E. Nicholson, president of the Kansas Portland Cement Company, of Iola, Kan., was elected the president and general manager of the Indian Portland Cement Company, of Neodesha, Kan. Mr. Nicholson also holds the position of president in the Independence (Kan.) Portland Cement Company, of Independence, Kan.

Quite a change has occurred in the personnel of the Alpena Portland Cement Company. Mr. Herman Besser succeeds Mr. Patrick Culligan in the presidency, Mr. Geo. B. Holmes succeeds Mr. C. H. Reynolds in the vice-presidency, Mr. Reynolds being Monaghan, who is sales manager, formerly being secretary and sales manager.

City and borough engineers have been elected and re-elected as follows: E. E. Colby, Chickasha, I. T.; Edgar Schmidt, Terre Haute, Ind.; James Owen, Caldwell, appointed secretary, succeeding Mr. John N. J.; Col. W. C. Croxer, Knoxville, Tenn.; William Newman, Windsor, Ont.; W. H. Sieverling, Springfield, O.; John E. M. Scott, Oneida, N. Y.; Francis C. Tucker, Deadwood, S. D.

MACHINERY AND TRADE

Interest in Hercules Exhibit at Milwaukee.

At the Cement Users' convention in Milwaukee in January the Hercules cement-stone machine was a star performer. Cement men had to see the blocks, ornaments, cornices, lintels, etc., made right before their eyes before they would believe that a simply constructed machine like the Hercules could turn out such a variety of shapes and sizes.

They saw a machine without a cog, a chain, a spring, a bolt or a pin in its make-up. They saw the adjustments easily and quickly made. Skilled labor is not required with a Hercules, for the machine is so simple that any man with ordinary intelligence can operate it.

The Hercules, by a clever combination, can make two stones of the same size and design or of different size and design at one time, an arrangement that cuts the cost of labor in two, doubles the capacity of the manufacturer and saves the cost of purchasing two machines. Tamping is done directly on the face, which means a clear impression of the design, and gives the stone a more natural appearance. Tamping on the face allows a 2-to-1 composition for facing and 5 to 1 for backing, which means a great saving. It also allows the making of the mixture more wet, which means a stronger stone.

The Century Cement Machine Co., West Main street, Rochester, N. Y., has just issued a handsome new catalogue explaining all about the 1906 model Hercules and illustrating factories, churches, residences and apartment houses built by Hercules machine-made stone, which will be sent upon request.

Test of the New Decarie Garbage Incinerator at Duluth.

The following concerning the test on February 12 of the new Decarie incinerator at Duluth, Minn., is taken from the Duluth *News-Tribune*:

Under the powerful blast of the 175-foot stack, garbage dumped into the new city incinerator installed by the Decarie company, of Minneapolis, at the formal test yesterday, was quickly consumed, without odor, a thin white vapor passing out of the stack after the incineration process had been completed.

Although the plant had been practically accepted by the special committee appointed by the Council to conduct negotiations for the plant, it was desired by Health Commissioner Murray that a public exhibition of its operation be given. Several of the aldermen, with heads of departments, were present on invitation, and immediately after the party was complete the fires were started in the big furnaces and wagons loaded with dead fish, meats, barnyard offal and a horse, with all the miscellaneous collection of ordinary garbage, were dumped into the furnaces through steel trap doors on the floor above.

The furnaces are of heavy steel plate, water-jacketed and tested to a steam pressure of 75 pounds to the square inch. The garbage is dumped from the wagons direct into the furnace, and it is held in suspension on tubular water grates until the moisture is driven out, when it falls into the lower grate and is quickly consumed. All the smoke is carried from the main furnaces into an auxiliary gas-consuming furnace, where the fumes are removed before reaching the stack. Nothing in the way of odor is allowed to reach the outer air.

For every ton of garbage consumed there result 45 pounds of ashes. The cost of operation, including labor and fuel, is 24 cents per ton of garbage, which is practically the same as that for maintaining an open-air dump. Its capacity is 80 tons in 24 hours.

Although the specifications under which the crematory for the city was installed do not require it, the incinerator dried and quickly burned barnyard offal. On account of the fact that this material is highly charged with ammonia, which banks the fires, the company refused to guarantee that the plant would burn it, but it did so yesterday, to the complete satisfaction of the members of the committee and the aldermen who watched the process. The carcass of the horse, which was dumped in from above for exhibition purposes, passed through the grates in the form of ashes in forty minutes.

Although the plant has not been operated to its capacity, two cords of slab wood purchased for fuel twelve days ago has not been exhausted.

A Palmer Concrete Block House in Waahington.

Three houses are to be built of hollow concrete blocks on Girard street, between Fourteenth and Fifteenth street, northwest, Washington, D. C., by the Palmer-Brouner Construction Company. H. S. Palmer, president of the Palmer-Brouner Construction Company, is the inventor of the machine with which the hollow con-

crete blocks are made. This machine is being largely used in various parts of the world.

The machine is operated at the site of the building operations, thus making possible a considerable saving in cost.

The blocks are composed of Portland cement concrete. About one-third of each block is a cavity, which also reduces the cost, and, it is said, makes a better wall.

Although this kind of construction is comparatively new in this section, it has been used in many large buildings in other cities. Among them are the Law Exchange of Jacksonville, Fla.; the Charlotte (N. C.) water works; the Staunton Military Academy, Staunton, Va., and a number of buildings in Pittsburg, Pa.

As an example of what results can be attained through use of the hollow concrete blocks, the three houses to be built by the Palmer-Brouner Company, a reproduction of the design of which appears on this page, will be sold for about $8,000.

The houses will be three stories in height and will each contain nine rooms, two baths and a large reception hall. There will be a handsome stairway and a spacious bay window in the parlor and front bedrooms. The finish inside will be of hardwood. The front doors will be of beveled glass, and the vestibule and bathrooms will be tiled.

Hot-water heating apparatus will be installed in the basement; also the laundry, with stationary tubs.

CONCRETE BLOCK HOUSE, WASHINGTON, D. C.
H. S. Palmer's Blocks.

Chicago Pneumatic Tools for England.

The American Car and Foundry Co. has purchased for its works at Manchester, England, 100 tools, consisting of "Boyer" hammers and drills, from the Consolidated Pneumatic Tool Co., London, which is a foreign branch of the Chicago Pneumatic Tool Co., Chicago, Ill.

Perrin's Cement Roofing Tile.

The cement tile made by the method of Perrin's Cement Tile Roof Co. is made of one part cement and two parts sand, mixed wet enough to pour, averages ⅝ inch thick and 11x8 inches in horizontal dimensions, and weighs 200 pounds a square less than slate. The upper projecting ribs of the lower tile and the overlapping of the top tile keep out driving rain, snow or dust. The under part of the tile has a staple, which is caught by a projecting wire attached to a roof board. When the roof is laid it is not necessary to plaster the coping on with cement. Any colors can be used and an artistic finish is given. The molds weigh but 45 pounds for a pair and are leased and territory is protected. Full information will be given by Perrin's Cement Roof Tile Co., 283½ North High street, Columbus, O.

The J. H. Strain Company.

The business formerly carried on by J. H. Strain, and also the interests of several other companies, have been purchased by the J. H. Strain Company, just incorporated. At a meeting of the directors, held at the principal office, 12 Elm street, New York, J. H. Strain was made president, Benj. W. Tucker vice-president, H. L. Crawford treasurer and Chas. E. Kane secretary. The company will handle steam road rollers, the Torpedo scarifier, improved Barnard-Castle street sweeper, improved Barnard-Castle pavement scraper, gutter plow, stone crushers, can carriers, galvanized-iron cans, push brooms, repair parts and castings; also will refill street sweeper cylinders with wire, bamboo or hickory. The new year, it is said, has opened up well for the company and numerous orders for its different specialties are already on hand. Among the orders received for the new road and pavement scraper which the company has placed on the market are those received from New York city, Washington, D. C., and White Plains, N. Y.

The Torpedo scarifier is a machine for breaking up old macadam pavement and preparing macadam pavement for resurfacing. By its use macadam pavement can be properly resurfaced without breaking the bond of the pavement. Picks in the rolling wheels of a steam roller break the bond of the pavement and no amount of rolling will serve to put the roadway back into its proper state. Scarifiers have been used in the old world for a great many years. Some machines are attached to the steam roller and made a part of it, while others are drawn by the steam road roller. The Torpedo scarifier has four wheels of equal size to carry its weight, and the weight is used to hold the picks into the roadway.

The Perfection Power Block Machine.

The writer has had an opportunity to examine the principles of operation of the Perfection power block machine, made by the Perfection Block Machine Co., Kasota building, Minneapolis, Minn. This company furnishes with its machine whatever is necessary to handle the material from the sandpile to the completed block.

The sand and aggregate of which the block is made is elevated by a bucket elevator to the top of the machine, where it is dumped into a hopper, from which it can be drawn into a measuring box containing the exact amount required for making a block. This box is adjustable to provide for varying proportions of cement and aggregates. The aggregate is then dropped, with the proper amount of cement from an adjacent measuring scoop, into a power mixer, which dumps into a box set on a swinging arm, which revolves to bring the box over the block mold, into which it is dropped. This mold is in the frame of the machine and is fitted with center core and wooden pallet. The end hollows on the blocks are made by molds on the end plates of the mold box. When the mold is filled the plunger of the machine is forced down a definitely determined distance by means of a toggle joint, and subjects the block to a pressure of 100 tons. As this plunger returns it is made to seize the core by means of a foot lever, and the core is drawn and the sides of the mold are turned down at the same time and the block is ready to remove. The various movements of the aggregate, the cement and the mixture are regulated by hand wheels convenient to the operator. Various forms and sizes of straight and corner blocks, halves and quarters are made by changing forms and by putting in division plates.

The earlier machines were operated by

hand, but with the addition of the power elevator and mixer it is found more economical to use a gasoline engine or electric motor to run the whole machine.

One of the troubles of the press for making blocks has been the disposition of the air in the concrete. This machine is said to take care of this thoroughly by means of its perforated core.

Although the machine has been on the market in its complete form but a few months, several large plants have been established. The largest contract for blocks ever let is being filled with blocks made on this machine in Minneapolis, where there are two machines in operation. Two plants, each with a capacity of 600 blocks a day, have recently been started in Beaumont, Tex., and New Orleans, La. The Wm. Penn Stone Co., of Superior, Wis., has large quantities of refuse from its stone-cutting yards, and has formed the Builders' Concrete Cast Stone Co., to install the Perfection machines and make up their 15 or 20 cubic yards of fine stone per day into concrete blocks.

Mr. M. K. Sawyer is the northwestern manager of the company, and he reports gratifying success in arousing interest and placing machines among those who wish to make good blocks and to cater to the best class of trade. He finds that his claims of higher quality of blocks and rapidity of manufacture and consequent low labor cost are successful in getting the attention of the best men in the trade.

Chicago To Try Bithulithic.

A recent decision of Judge Carter, of the County Court of Cook county, Illinois, in which he interprets the statutes of that State relative to the use of patented articles, seems to have cleared away the haze in wihch this much-quoted and much-abused law has been enveloped. Justice Carter's decision was brought about by the case of Prindle vs. The City of Evanston, Ill., in which the petitioner sought to have set aside an ordinance providing for the paving of Maple avenue with bitulithic. The contention of Prindle was that under the statute of improvements a patented article could not be used, as it would tend to foster and create monopoly, and was therefore unlawful. Justice Carter denied the motion for an injunction, and the Evanston ordinance for bitulithic was sustained.

Justice Carter, in his decision, appears to have followed closely the line of reasoning set up by Justice Woods, of the Supreme Court of Missouri in the case of Swift vs. The City of St. Louis, in which remonstrants sought to have set aside an ordinance for bitulithic, the law of Missouri in regard to uatented articles being similar to that of Illinois. Justice Woods ruled that "the grant of power to the Board of Public Improvements for the construction of streets is for public purposes and is for the benefit of the city and property owners. The prescription to let the contract to the lowest bidder is a mere regulation and not a limitation of the power. The proposition is illustrated in the case where, for instance, the city authorities have selected Nicholson pavement for a street, or Trinidad Lake asphalt, which material, in the one case, is controlled by a patent and in the other case by a monopoly, and it has been held that the authorities, in the interests of the public, are not bound to wait, for instance, until a patent has expired or a monopoly has perished so that competition may be secured, but may, in the exercise of their legislative discretion for the benefit of the public, select the patented or monopolized article, and an ordinance requiring the use thereof is not void because the contract can not be awarded to the lowest bidder."

Interest in the decisions of Justices Carter and Woods is aroused by the fact that taxpayers in Woodlawn avenue, Chicago, petitioned the Board of Aldermen for the passage of an ordinance for paving that thoroughfare with bitulithic. Opposing interests sought to defeat the adoption of the ordinance on the ground that under the statutes of Illinois it was illegal to lay a patented pavement. The Board of Aldermen duly considered the arguments of the opposition and evidently felt secure in the legality of their position, as the ordinance providing for bitulithic in Woodlawn avenue was passed by a vote of 4 to 1.

Trade Publications.

Mr. Wm. F. Morse, 25 Broad street, New York, the American representative of Meldrum Bros., Ltd., sends "The Book of the Destructor," which is somewhat more than a trade catalogue, for it goes into considerable detail regarding the history of garbage and refuse destruction and the construction and operation of the highest systems of incineration of waste, with results of actual operation of many of the seventy odd plants built by this firm in work done and cost thereof. It is fully illustrated and will be of much interest in this country, where the methods of reducing garbage and of attempting to burn it without the combustible refuse which is collected with the garbage in

England, have not been as successful as we would like. There are signs of a change in views regarding the matter of refuse disposal, and such books as this will doubtless be called for very generally.

The Non-Staining Cement Co., 156 Fifth avenue, New York, issues the "Lafarge Book," which is unique in its form and contents and gives a very complete idea of the value of Lafarge cement as non-staining and therefore suitable for fine stone and cement brick laying, stucco, smooth finish, artificial stone, etc. The value of clean sand for such work is also emphasized.

"Heat and Light from Municipal and Other Waste," by Jos. G. Branch, B. S. M. E., is a reference book for municipalities and engineers, being 200 pages of official reports from 300 American and English cities on the reduction and incinerating methods of disposing of garbage, with treatise on the utilization of waste heat for electrical and power purposes; also reports and full explanation of the different central heating plants and heating systems, with full description of the Branch garbage incinerator in connection with such plants and systems. It is for sale by the National Equipment Co., St. Louis, Mo.

The Atlas Portland Cement Co., 30 Broad street, New York, has just published a booklet entitled "Concrete Construction About the Home and on the Farm," which will be very valuable for those who are interested in this class of work, whether as owners of the property or workers in cement. It includes specifications for mixing and handling cement, forms for placing it, table for designing reinforced concrete beams and slabs, and quite full instructions for making sidewalks, floors, walls, steps, stairs, cellars, ice boxes, foundations, piers, posts, chimney caps, cisterns, watering troughs, tanks with and without reinforcement, well curbs, horse blocks, piazzas, lattice, cow barns, hog pens, chicken houses, ice houses, root and mushroom cellars, greenhouses and hot beds, box stalls, silos, culverts, stucco, farm buildings, etc. The book is fully illustrated with photographs of work, plans and pictures of tools and apparatus. Copies will be sent by the Atlas Portland Cement Co. on request.

"Fineness" is the subject of Cementology for February, the little publication of the Whitehall Portland Cement Co.

The Wirt & Knox Mfg. Co., 22 North Fourth street, Philadelphia, has issued its catalogue of Wirt's patent hose carts, reels and racks for 1906. It is maintaining its full line of styles, sizes, capacity and equipment, and is adding some attractive new styles and sizes. Copies of the booklet will be sent to any one desiring them.

The Wright Concrete Machine Co., Columbus, O., has issued a poster showing the details of its complete list of machines, which now includes three "Wright" block machines, three "Columbus" block machines, a continuous concrete mixer, a power tamper and a special cap and two-piece block mold.

The South Bend Machine Mfg. Co. issues a catalogue of the Standard cement brick machine and concrete mixer.

The Standard Machine Co., Kent, O., issues a circular descriptive of the Standard continuous concrete mixer.

Trade Notes.

ASPHALT.

Cincinnati, O.—Alfred Macbrair, chairman street committee of the Business Men's Club, urges the immediate establishment of a municipal asphalt and bitulithic repair plant.

BRICK.

Crandon, Wis.—Tests of clay on the land of L. T. Crabtree show it to be suitable for making hollow brick.

Luverne, Minn.—R. B. Hinkly has installed machinery and will manufacture wire-cut brick, hollow brick, sewer and drain tiles.

St. Anne, Ill.—The St. Anne Brick and Tile Company is being organized here to manufacture brick and tile, by F. H. Meier, A. Mailleux and J. B. Broullette.

Marysville, O.—The Marysville Clay Manufacturing Company has been organized by capitalists of this city to manufacture brick and other articles made of clay. The incorporators are B. M. Rutan, N. E. Liggett, H. E. Conkright, Thos. Sharrer, and W. C. Fullington.

Columbus, O.—The Granite Brick Company, organized some time ago, has completed its plant on Dublin avenue and is making brick from lime and lake sand. The officers of the company are: President U. P. Lenox, of Richwood; vice-president, O. W. White, of Plain City; treasurer, W. L. Curry, of Columbus; secretary, J. E. Robinson, of Columbus; manager, C. A. Rausch, of Plain City.

Carrollton, O.—The Minerva Brick Company has begun the manufacture of paving block.

Emmetsburg, Ia.—The Emmetsburg Brick and Tile Company has been organized with G. G. Wheat as president; H. C. Shadbolt, vice-president; E. B. Persons, secretary; E. Soper, treasurer.

CEMENT.

Portage, Wis.—The Wisconsin Portland Cement Company has elected officers as follows: President, Emil Durr, Milwaukee; vice-president, S. T. Meservey, Fort Dodge; treasurer, Joseph M. Boyd, Madison; secretary, F. M. Merrell, Portage. The company contemplates the construction of a plant at Lake Ennis, Marquette county, about 12 miles from this city, at a cost of $400,000, and with a capacity of 1,000 barrels of cement per day.

Birmingham, Ala.—The National Portland Cement Company will establish a

plant at Leeds, near this city, at a cost of $1,500,000.

Brazil, Ind.—The Western Tile and Cement Company has been incorporated by Lewis McNutt, Blair McNutt, and Charles McConnell.

Springfield, Ill.—The Springfield Sand and Cement Company has been incorporated for gravel and cement construction, by Charles H. Freitag, George F. Stelte, and J. R. Gardner.

Wellston, O.—A cement plant will be constructed 4½ miles east of this city by D. Linn Gooch, of Covington, Ky., J. A. Leonard, of Wellston, and V. O. Foulk, of Indianapolis. D. Linn Gooch is president.

Easton, Pa.—The Knickerbocker Trust Company, of New York, has brought suit as trustee against the Quaker Portland Cement Company and Anna M. Teel, F. R. Gardner, and F. L. Keller, tenants, to foreclose a mortgage for $25,000,000 on franchises and property at Sandts Eddy. It is alleged that the Quaker company has failed to pay the agreed interest on money loaned by the Knickerbocker company and the Delaware & Northampton Railroad Company for improvements.

Mason City, Ia.—The Indian Portland Cement Company, of Neodesha, Kan., is preparing to erect a cement plant here of 3,500 barrels capacity.

Milford, N. D.—The Pembina Portland Cement Company will enlarge its plant to 500 barrels per day.

Rapid City, S. D.—The Consolidated Railroad Cement Corporation has been former to build a cement plant here with a capacity of 350 barrels per day.

Calgary, Alberta, Can.—The Alberta Portland Cement Company is making good progress with its buildings and expects to be in the market with its product by June 1.

Jeffersonville, Ind.—W. E. Williams, of Chicago, who purchased the plant of the Standard Cement Company, at Charlestown, Ind., contemplates enlarging the plant, at a cost of about $1,000,000.

Denver, Colo.—Special. The McPhee & McGinnity Company advises us that they have taken over the exclusive sale of Iola cement in Colorado and Northern New Mexico for the coming year, and that William Hayden has been engaged as sales agent of the cement department.

Ann Arbor, Mich.—About 30 stockholders of the Toledo Portland Cement Company, which was organized to manufacture cement at Manchester, where a free site was given them by the people, have joined in a bill of complaint against the company. A petition filed by the creditors has thrown the company into the bankruptcy court at Detroit, and the Manchester investors claim that it is a freeze-out game.

Cement City, Wash.—The cement plant now being constructed here will be completed and ready for operation by April 1. E. C. Miller is manager.

CONCRETE BLOCKS.

Dawson, Minn.—Erick Bjorman has purchased the cement block business of W. H. Carson.

Imogene, Ia.—W. D. Crone will resume the manufacture of cement stone this spring.

Connell, Wash.—W. A. Lauder, of Moscow, Idaho, will engage in the manufacture of cement blocks here.

Drake, N. Da.—A plant for the manufacture of cement blocks will be erected here by T. E. Sleight.

Norwood, Minn.—A patent has been granted Casper Spies for a reinforced cement fence post, and he will sell patent rights. Mr. Spies is also devising other articles of cement.

Glencoe, Minn.—The Woodmen-Odd Fellows Building Association will, according to press reports, engage in the manufacture of concrete blocks as a permanent business. A. A. Cavanaugh will be president.

Bloomer, Wis.—J. S. Emmerton has purchased a machine and will make cement brick.

Brewster, Minn.—Montgomery Brothers have constructed a machine of their own design and are experimenting in the manufacture of brick and building blocks.

Walnut, Ia.—Peter Knugger and Jens Larsen have purchased a concrete block plant.

Battle Lake, Minn.—A. C. Hatch contemplates adding cement tile-work to his brick-yard.

New Richland, Minn.—W. F. Rourk will manufacture sidewalk tile.

Ortonville, Minn.—John A. Anderson will engage in the manufacture of concrete blocks.

Lake City, Ia.—The plant of the Electrical Cement Post Company will be enlarged and new equipment added.

Towner, N. D.—Hans P. Olson will engage in the manufacture of concrete block, posts, tile and brick.

New Ulm, Minn.—Reiser & Langmack will engage in the manufacture of cement tiling from 8 to 24 inches.

Superior, Wis.—The Builders' Concrete Cast Stone Company has been incorporated by E. W. Balknap, J. E. Irvone and J. F. Tostevin, Jr. The Perfection block machine, manufactured by the Perfection Block Machine Company, 501 Kasota building, Minneapolis, will be used.

Indianapolis, Ind.—The Concrete Construction Company has been incorporated here by Wilbur A. Bruce, Alfred J. Ralph and Nelson F. Scribner.

San Francisco, Cal.—The Pacific Concrete Machinery Company, 321 Market street, has introduced a cement-post machine which produces a cement post at from 15 to 16 cents per post, according to press reports. The cost of the machine is said to be $40, complete.

Cooperstown, N. D.—The Cooperstown Tile Works, which have been closed since the holidays, will begin operations about March 1. The company had added a cement-post machine and may install a cement-brick machine.

Sandstone, Minn.—T. R. McCormick contemplates the manufacture of concrete blocks.

La Crosse, Wis.—H. R. Schmohl, of Chicago, has begun the manufacture of ornamental and cement products here.

Becker, Minn.—N. K. Nelson has engaged in the manufacture of sidewalk tile, blocks for window sills and caps.

Elk Point, S. D.—The Moon Lumber Company has purchased a Miracle outfit and will engage in the manufacture of concrete blocks.

Lindstrom, Minn.—Charles Andrews and C. A. Victor will engage in the manufacture of concrete blocks.

Milwaukee, Wis.—The Monolith Concrete Construction Company has been incorporated by Henry Ferge, August Reichert and Richard Ferge.

Pensacola, Fla.—Special. The building committee appointed by the City Council in the limited competition selected Frederick Ausfeld as architect of the proposed new $75,000 City Hall.

Louisville, Ky.—Special. The Belknap Hardware and Manufacturing Company,

111-121 W. Main street, advises us that they will have plans and specifications ready shortly for a reinforced concrete building, brick curtain wall, 195 by 175, with basement and 7, 8 or 9 stories, according to the bids received on the different number of stories. Contractors who desire to bid are asked to send in their names, so that they may be notified when the plans and specifications are ready.

Golconda, Ill.—Special. John Mulholholland, president of the Fairview Fluor-Spar & Lead Company, advises us, under date of February 15, that he wants to correspond with interested parties regarding the construction of reinforced concrete bins 200 by 42 by 20.

Warsaw, O.—The Warsaw Sand and Lime Brick Company has been incorporated by P. M. Moore, J. F. Wagner, Mathew Crawford, J. H. Elder and James L. Beck.

Mentor, O.—The Mentor Manufacturing Company has been incorporated to manufacture concrete products of all kinds, by W. E. Harvey, C. J. Scott, F. C. Babcock, F. J. Parmalee and Justina C. Parmalee. The company is owner of certain patent rights.

PURCHASE OF MACHINERY.

Franklin, Pa.—Special. P. G. Burford, 313 Liberty street, desires to purchase machinery and tools for concrete and stone bridges, cement brick and blocks.

Springfield, Minn.—Special. P. C. Hansen, Box 355, advises us that he desires to purchase a cement-block machine and mixer.

Russellville, Ala.—Special. F. E. Harte advises us that he desires prices for cash on concrete-stone machines, with all attachments. He also desires to know the freight rate the firms can get for him, f. o. b. cars Russellville, Ala.

Redonda, Cal.—Special. P. S. Venable & Co. advise us that they desire to purchase a cement mixer.

Atlanta, Ga.—Special. C. H. Marquess, C. E., Fourth National Bank building, desires to purchase machinery and tools for reinforced concrete work.

Hammond, Ind.—Special. The Reed-Bump Construction Company, Room 4, Tapper block, advise us that they desire to purchase concrete conveyors and mixers.

Fort Frances, Ont.—Special. A. E. Cline desires to purchase a concrete mixer and a cement-brick machine.

Northfield, Minn.—Special. F. O. Rice, city engineer, advises us that he desires to purchase machinery and tools for everything pertaining to cement work.

Glenwood, Minn.—Special. George Hallatt advises us that he is in the market for block machines.

Boston, Mass.—Special. Jos. F. Wilber, 534 Albany building, desires to purchase machinery and tools for concrete construction.

Camilla, Ga.—Special. W. W. Cullens is in the market for cement-brick and hollow-block machines, and for machinery for all concrete work.

Franklin, Ky.—Special. A. V. Biggs, of the Biggs Coal Company, is in the market for plates or letters for making inscriptions on granitoid monuments or markers. He desires hollow or sunken molds which makes raised or round letters, and desires to correspond with parties manufacturing such letters or molds.

Minneota, Minn.—Special. S. W. Jonason advises that he is in the market for cement-block machinery and mixers.

East Palestine, O.—Special. J. A. Benzenhoefer desires to purchase cement and block machinery.

Schenectady, N. Y.—Special. Elmer E. Stanton, 74-75 Parker building, advises us that he desires to purchase the entire equipment for a clay-brick plant. He will also sell a concrete equipment. Mr. Stanton also desires competent men as superintendents, as he has six plants in operation.

Burlington, Ia.—Special. William M. Service, northwest corner Fourth street, advises us that he is in the market for cement-block machines, molds and tools.

Lyndonville, N. Y.—Special. T. H. Nie, Riverside street, advises us that he will construct a building for his building-block business before next fall, and desires plans for same. He also desires to purchase conveying and screening machinery.

Valparaiso, Ind.—Special. C. H. Dickover advises us that he is in the market for cement-block machinery.

Chicago, Ill.—Special. Arthur E. Hales, 709 W. 116th street, is in the market for municipal work.

Portland, Ore.—Frank Lucas, of the Modern Stone and Supply Company, states that the company has two block machines, but may want molds for a variety of other things.

Herington, Kan.—Special. P. O. Randebaugh & Co., Box 1304, desires to purchase machinery and tools for making cement sidewalks and cement blocks.

St. Cloud, Minn.—Bids are asked until March 5 for one 10 to 12-ton stone crusher and one 24-foot elevator, and one 3-section 24-inch screen. J. E. Hill, city engineer.

Galveston, Tex.—Special. N. J. Clayton, architect, 1205 Thirty-fifth street, desires to purchase grain elevator machinery.

Chicago, Ill.—Special. Joslyn Bros., 422-445 La Salle street, advise us that they desire to purchase concrete machinery.

Quebec, Que.—Special. J. O. Montreuil, C. E., Maple avenue, advises us that he has formed a company for the manufacture of building blocks, sewer and culvert pipes, and fence posts. He contemplates the purchase of the necessary machinery for the plant, and desires information regarding any stainless cements that are on the market.

Louisville, Ky.—Special. Morris, Kaye & Co., 81 Todd building, advise us that they are just organizing a company for general concrete construction along the line of residences.

Columbus, O.—Special. Charles E. Perkins, State engineer, advises us that Council has under consideration the purchase of a steam road-roller.

PURCHASE OF MATERIALS.

Quebec, Que.—Special. J. O. Montreuil, C. E., Maple avenue, advises us that he desires information regarding any stainless cements on the market.

Galveston, Tex.—Special. N. J. Clayton, architect, 1205 Thirty-fifth street, desires to purchase brick, lumber, iron castings, Portland cement, terra cotta, etc.

Minneapolis, Minn.—Special. H. M. Hickok, 315 W. Fifteenth street, is on the market for lumber, stone and cement.

Grand Rapids, Mich.—Special. C. E. Williams, 233 Scribner street, advises us that he desires names and addresses of firms that furnish sandstone curbing.

Athens, Pa.—Special. The Macafee Concrete Company desires to purchase crushed stone.

Herington, Kan.—Special. P. O. Randebaugh & Co., Box 1304, advise us that they

desire to purchase coarse sand and cement.

East Palestine, O.—Special. J. A. Benzenhoefer desires to purchase cement.

Minneota, Minn.—Special. S. W. Jonason is in the market for cement and lumber.

Camilla, Ga.—Special. W. W. Cullens is in the market for cement and gravel.

Sleepy Eye, Minn.—Special. Fred C. Koehne, 204 E. Main street, of the Sleepy Eye Paving Works, desires prices on carload lots of cement, f. o. b. Sleepy Eye.

Glenwood, Minn.—Special. George Hallett advises us that he desires to purchase cement.

Mishawaka, Ind.—Special. V. Brenner advises us that he desires the names of firms making waterproofing for cement blocks.

Fort Frances, Ont.—Special. A. E. Cline is in the market for cement and lime.

Atlanta, Ga.—Special. C. H. Marquess, C. E., Fourth National Bank building, advises us that he is in the market for reinforced concrete.

Golconda, Ill.—Special. The Fairview Fluor-Spar and Lead Company advise us that they desire to purchase 50 carloads of cement, March and after delivery.

Redondo, Cal.—Special. P. S. Venable & Co. desire to purchase cement.

Americus, Ga.—The American Tile and Artificial Stone Company, manufacturers of tiling and artificial stone, advise us that they are in the market for vitrified street and sidewalk paving brick and paving materials.

Franklin, Pa.—Special. P. C. Burford, 313 Liberty street, is in the market for cement paving brick and sewer pipe.

LIGHT, HEAT AND POWER.

Chicago, Ill.—The Horto Electric Company has been organized to manufacture electrical appliances, by Benjamin C. Bachrach, Henry A. Berger and Benson Landon.

Chicago, Ill.—The American Electrical Construction Company is being organized to manufacture supplies, insulation, etc., by Henry Maryin, William H. Duval and Alice E. Goodman.

Chicago Heights, Ill.—Special. With the consent of the Marinette Gas Engine Company, the superior court of Cook county, in the suit of the Bank of Chicago Heights, holding a claim of $12,000 against the company, appointed a receiver for the company with power to wind up its affairs, pay off the creditors, distribute the surplus among the stockholders. Joseph H. Dalton, vice-president of the Marinette Gas Engine Company, says:

In view of the fact that the company found itself financially embarrassed, it was thought best by the directors not to oppose the necessary steps taken to preserve the assets for the creditors and stockholders in the manner above stated. We consider the company amply solvent, and, under the present administration, believe that the receiver will be able within a short time to pay all the creditors in full and have a surplus for the stockholders.

MISCELLANEOUS.

Portland, Me.—The Rice Gasoline Rock Drill Company has been organized here to engage in manufacturing, mining, smelting, construction and transportation of any kind, with officers as follows: President, Henry I. Jordan, Portland; treasurer, Arthur H. Whitman, Portland.

Toledo, O.—The Toledo-Massillon Construction Company has been incorporated to build all bridges for the Toledo-Massillon Bridge Company, by Thomas H. Tracy, C. A. Peckham, C. S. Davis, Charles F. Chapman, Jr., and Frank W. Caughing.

Johnstown, Pa.—The Eichensehr Lubricator Company has established a plant here for the manufacture of a patent lubricator, which, it is claimed, will oil a horizontal engine while in motion, furnishing a steady flow of oil.

Chicago, Ill.—Special. Wilbur H. Traver, formerly connected with the Rand Drill Company, for a period of twelve years, as manager of the Chicago territory until the consolidation of the Ingersoll-Rand companies, after which time he was manager of the railroad department, with headquarters in Chicago, has now severed his connection with the Ingersoll-Rand Company and accepted service with the Chicago Pneumatic Tool Company as manager of the mining and contract department. Mr. Traver will devote his time and attention principally to the sale of air compressors, rock drills and mining machinery.

The Austin Manufacturing Company, of Chicago, report business very good for this time of the year. The sales for the year 1905 exceeded by 50 per cent. those of previous years. Their extensive works, located at Harvey, Ill. (suburb of Chicago) are well stocked, and many orders are being booked each week for crushing machinery, also contractors' outfits, well and road machinery. "We are selling the leading quarrymen, contractors, cement companies, in fact, the cream of the trade," said their sales manager. "Just glance at this list of recent purchasers—it only covers about two weeks' sales." (We publish it for the benefit of prospective buyers): United States Government, for Manila, P. I., No. 3 crushing plant; Chattanooga Blast Furnace Company, Chattanooga, Tenn., No. 7½ crushing plant; Rio de Janeiro Tramway L. & P. Co., New York, N. Y., No. 5 crusher; Widell, Finley & Co., Mankato, Minn., No. 5 and No. 3 crushing plant; W. & J. Lempriere, Melbourne, Australia, No. 5 crusher; Hunkins-Willis Lime and Cement Company, St. Louis, Mo., No. 3 crushing plant; the United States Cement Company, Indianapolis, Ind., No. 6 crusher; Greenleaf Stone Company, Milwaukee, Wis., No. 7½ crushing plant; Wm. McIntyre & Sons, Struthers, O., No. 3 crushing plant; O. K. Building and Construction Company, Oklahoma City, Okla., No. 8 crushing plant; Couch & Franklin, Charleston, W. Va., No. 5 crushing plant; J. M. Hamilton, Marion, O., No. 5 crushing plant; Phil Wilk, Rushville, Ind., No. 2 crushing plant; Gibraltar Quarry Company, Detroit, Mich., No. 7½ crushing plant; W. J. Neale, Waco, Tex., No. 5 crushing plant; L. H. Stevens, Coffeyville, Kan., No. 5 crushing plant; Mike Elmore, Cherry Run, W. Va., No. 5 crushing plant. Their 1906 gyratory crusher catalogue, containing nearly 150 pages, will soon be ready for distribution, and anyone contemplating the purchase of crushing machinery will find this publication of great interest. It is said to be the largest and finest catalogue of rock and ore crushers ever published.

SEWER PIPE.

Barberton, O.—The American Sewer Pipe Company, of this city, has purchased the plant and property owned by the Diamond Brick Company, for $57,500.

Recent Patents Concerning Cement and Its Uses.

780,942. Fence Post. John L. Dillon, Bloomsburg, Pa.

780,950. Rail Tie. Wm. F. Kerlin, Rockfield, Ind.

781,086. Jan. 31, 1905. Reinforced Concrete Structure. Ray C. Newhouse, Columbus, O.

781,105. Wire Fastener for Cement Fence Posts. Adolph M. Snyder, New Carlisle, O.

781,143. Cement Block Machine. Charles F. Harris and Berkley W. Duck, Indianapolis, Ind.

781,457. Automatic Sand Sifter and Mortar Mixer. Paul B. and August C. Quade, Athens, Miss.

781,514. Mold for Forming Fence Posts, etc. William Gray, Marshall, Mich.

781,611. Molding Flask for Making Fence Posts. Harold A. Low, Lake City, Iowa.

12,309. Reissue. Machine for Mixing Concrete or the Like. Wm. J. Judd, New York, N. Y.

782,230. Feb. 14, 1905. Mold for Making Artificial Stone Building Blocks. James Finger, Ft. Collins, Col.

782,351. Artificial Stone Block, Marcellus O. Mullenix, Springfield, O.

782,441. Wall Construction. John A. Ferguson, Denver, Col.

782,446. Outside Form for Cement Work. Crest Gustafson, Oakland, Cal.

782,515. Artificial Stone Base. Clinton C. McElhaney, Rockfalls, Ill.

782,557. Floatable Concrete Pier. Samuel Hadlock, Port Hadlock, and Francis E. Brown, Port Townsend, Wash.

782,797. Machine for Making Cement or Concrete Catch Basins. John M. Phelan, Jackson, Mich.

782,865. Feb. 21, 1905. Fence Post. John F. Martin, Marshall, Mich.

782,877. Concrete Metal Construction. William H. Roney, Chicago, Ill.

783,017. Machine for Forming Building Blocks from Plastic Material. Hiram J. Buchanan, Auburn, Ind.

783,103. Cement Mixer. Robert B. Coltrin, Jackson, Mich.

783,299. Machine for Molding Plastic Blocks. Joseph M. McDowell, Columbus, O.

783,305. Concrete Building Block. George L. Peabody, Pittsburg, Pa.

783,355. Fence Post. Arthur D. Benham, Milford, Mich.

783,451, 783,452. Feb. 28, 1905. Building Block and Mold for the Manufacture of Same. Eugene Morenus, Cleveland, N. Y.

783,539. Building Construction. Emile G. Perrot, Philadelphia, Pa.

783,544. Wall Slab. David E. Roberts, Ft. Dodge, Iowa.

783,575. Inside Form for Sewer Work. Crest Gustafson, Oakland, Cal.

783,598. Fence Post. Arthur O. Tabor, Waterloo, Iowa.

783,629. Fence Post. Gustavus Garrett, Cambridge City, Ind.

783,703. Post. Daniel R. Porter, Chelsea, Mass.

783,767. Mold for Concrete Walls. Olof E. Wennberg, Chicago, Ill.

783,820. Artificial Stone Mold. John B. Clayton, Kirkwood, and Reno D. O. Johnson, St. Louis, Mo.

783,901. Fence Mold. Quincy G. Sheldon, Elburn, Ill.

783,928. Mold for Concrete Walls. Preston H. Clingan, Florence, Col.

784,033. Mar. 7, 1905. Fence Post. Solon O. Campbell, East Peru, Iowa.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Indianapolis, Ind.—The Board of Public Works has received a communication from J. K. Cooper, president of the Union Asphalt Construction Co., of this city, stating that the company is in position to construct asphalt pavements at a cost of less than 52 a sq. yd. during the coming season.

Knoxville, Tenn.—The Board of Public Works has instructed Capt. W. W. Crozer, city engineer, to take notice of all pavements and see that they come up to the specifications. The board also advocates the amendment of the present paving ordinance so as to provide that when brick is to be used for sidewalks vitrified brick be requested. Concrete sidewalks and gutters are advised, however.

CONTEMPLATED WORK.

Cambridge, O.—Paving is contemplated for the streets of this city.

Bay City, Mich.—The residents on Belinda st. desire brick paving.

Waco, Tex.—Paving is contemplated for Franklin st. from 5th to 8th sts.

Portsmouth, O.—Paving is contemplated for John st. from Gallia to 7th sts.

Logansport, Ind.—Brick paving is contemplated this spring. C. S. Tucker, cy. engr.

Elgin, Ill.—Ordinances have been passed for 2 mls. of new paving. Mayor Botsford.

Bristol, Tenn.—The question of improving the streets is being discussed by the City Council.

Belvidere, Ill.—An ordinance has been passed for paving Buchanan st. from State to Whitney.

Guyandotte, W. Va.—The question of issuing bonds for paving and sewers will be voted on in April.

Kokomo, Ind.—Brick and macadam is proposed for sundry streets this spring. W. F. Mann, cy. engr.

Jacksonville, Fla.—A boulevard from

this city to Palatka is contemplated by county commissioners.

Little Rock, Ark.—An ordinance is pending providing for the paving of 17 streets. E. A. Kingsley, cy. engr.

Little Rock, Ark.—Asphalt paving is contemplated for Scott st. from 3d to 18th. W. E. Lenon, mayor.

Swayzee, Ind.—The Town Board is considering the question of brick paving. B. Henley, town clk.

Troy, N. Y.—The question of paving 15th st. from People's ave. to Congress st. is being agitated.

Macon, Ga.—The macadamizing of the roads in Bibb county is contemplated. R L. Henry, chmn. co. comrs.

Wabash, Ind.—About 50,000 sq. ft. of cement sidewalks will be constructed this spring. John Hilty, engr.

Ensley, Ala.—Paving is contemplated for the principal streets in the business section of this city.

Watertown, N. Y.—Plans and specifications are to be prepared for paving Union st. Henry A. Baker, cy. engr.

Akron, O.—City Engr. Payne has prepared estimates of the cost of paving Perkins st. from Union to Arch, with brick.

Fort Wayne, Ind.—Bids will be asked for about March 1 for sheet asphalt and brick paving. F. Randall, cy. engr.

Superior, Wis.—Paving is contemplated for 7th st. from Bank to Clough and 13th st. from Oakes to Hammond.

Huntington, Ind.—About 40,000 sq. yds. macadam, brick or asphalt paving is contemplated. H. H. Wagoner, cy. engr.

Minneapolis, Minn.—Specifications have been prepared for 45,000 sq. yds. of creosoted wood block paving.

Decatur, Ill.—Bids will be received during March or April for paving N. Church and N. Union sts. with asphalt.

Tulsa, I. T.—The property owners on 1st st. have decided in favor of macadam paving. About 1 mi. will be laid.

Phoebus, Va.—Bids will be received soon for constructing 26,000 sq. yds. of street paving. L. P. Furness, mayor.

Fort Worth, Tex.—An effort is being made to secure the paving of Jennings ave. from 10th st. to the viaduct. Mayor Powell.

Seattle, Wash.—The Chamber of Commerce recommends the construction of a boulevard system in the outlying districts.

Covington, Ky.—Ordinances have been submitted to Council providing for brick paving, curbing, etc., on several streets.

Memphis, Tenn.—Local press reports state that there are many miles of sidewalks in this city that are not paved.

Brooklyn, N. Y. — Asphalt paving is proposed for the streets in the Bedford section, now covered with cobble stones.

Huntsville, Ala.—This city will issue $10,000 bonds for street improvements. Vitrified brick will probably be used.

Champaign, Ill.—A new petition is being circulated asking that Clark st. be paved with brick instead of asphalt.

Muncie, Ind.—Resurfacing and asphalt paving is contemplated for a number of streets this spring. J. O. Potter, cy. engr.

Madison, Wis.—This city will be ready for estimates about March 1 for constructing 3 mls. of macadam paving. John Icke, cy. engr.

North Yakima, Wash.—Contracts will be let about April 1 for constructing 133 mls. of road between this city and Bethel.

Savannah, Ga.—Paving is contemplated for Whitaker st. from Gaston to Park ave. and Price st. from Gaston to Gwinnett sts.

Nashville, Ill. — This city will issue bonds for $40,000 for permanent improvements, principally paving the streets. Mayor P. Zeigel.

Albany, N. Y.—An ordinance has been passed for paving Perry st. from Central to Clinton aves. Isidore Wachsman, clk. Bd. Cont. and sup.

Auburn, Ind.—Asphalt paving is contemplated for 8th and 9th sts., and bids will be asked about April 1. F. R. McDowell, cy. engr.

Wilmington, Del. — Specifications are being prepared and bids will be asked soon for improving the New Castle causeway. M. Boughman, cy. engr.

Rock Island, Ill.—Bids will be asked for this spring for paving 16th st. from 10th to 12th aves. with asphalt. H. C. Schaffer, cy. clk.

Ashtabula, O.—The property owners on Prospect st., from Division to Lake, have petitioned for asphalt paving. Lewis Amsden, cy. engr.

Newport, Ky.—Kentucky rock asphalt will probably be given a test for street-paving material in this city. Bailey Morlidge, engr.

Knoxville, Tenn.—A petition is being circulated asking that Broadway be paved from the Southern railway to the northern corporation line.

Fall River, Mass.—The superintendent of streets has been directed to let a contract for 17,000 ft. of granite curb and 250,000 granite blocks.

Marion, O.—Franklin st. from Bradford to Vine will be paved with asphalt, and Columbia st. from David to High with asphalt or block asphalt.

Cleveland, O. — The National Good Roads Association will begin work within the year on a great highway extending across the State of Ohio.

Argentine, Mo.—The property owners on 5 streets have petitioned the county commissioners to authorize the paving of streets in this city.

El Paso, Tex.—Plans and specifications have been prepared and bids will be asked soon for paving the streets in the business section of this city.

Port Huron, Mich.—Bids will probably be asked for about April 1 for a contract for 1 yr. for constructing cement sidewalks. W. W. Phelps, cy. engr.

Goshen, Ind. — A resolution has been passed to construct 14,666 sq. yds. of brick paving on gravel foundation on S. Main st. John L. Cooper, cy. engr.

Knoxville, Tenn.—The question of using vitrified brick and concrete for constructing sidewalks is being urged here. Capt. W. W. Crozer, cy. engr.

Barnesville, O.—Bids will be asked soon for furnishing quantities of limestone for constructing the Barensville and Hendrysburg highway.

Penn Yan, N. Y.—Thos. S. Burns, vil. prest., and Trustees Harrison and Caviston have been appointed a committee to ascertain the expense of paving Jacob st.

Hattiesburg, Miss.—A committee composed of members of the City Council visited Birmingham, Ala., Feb. 14, to investigate bitulithic paving. Cy. Engr. Huston.

Ottumwa, Ia.—Special. C. R. Allen, cy. engr., says the City Council has passed resolutions for paving 4th, Wapello and Albany sts. with brick, aggregating 10,400 sq. yds.

Lawrence, Mass.—The finance committee has recommended that $1,000 be expended in constructing concrete sidewalks in Storrow Park. The contract will be let this spring.

Tacoma, Wash.—The property owners

on Center st. petitioned for paving from S. 27th st. to Park ave. K st. from Division ave. to 19th st. will be paved with asphalt.

South Bend, Ind.—Plans and specifications have been prepared and bids will be asked about March 1 for paving several streets with brick and asphalt. Wm. McInerny, chairman Board of Public Works.

Los Angeles, Cal.—A petition is being circulated by the East Los Angeles Improvement Association to secure the paving of Downey avenue from the river east to Mission road.

Rochester, N. Y.—Bids will be received about March 1, according to local press reports, for paving East avenue. Bids are desired on all kinds of pavements. Edwin A. Fisher, city engineer.

Indianapolis, Ind.—Asphalt paving is contemplated for Twentieth street from Talbot avenue to Central avenue, and cement walks and curbs for Sanborn, Thirty-first, Thirty-second, and Karcher streets, and Congress avenue.

Denver, Colo.—Details and specifications have been adopted by the Board of Public Works for grading roadway and sidewalk areas, constructing concrete curb, etc., in the Northside Improvement District No. 1.

Salt Lake City, Utah.—Plans and specifications have been approved and bids will be asked soon for constructing the Wasatch drive. A. F. Doremus, J. D. Murdock, Lewis P. Kelsey, L. C. Kelsey, sub-committee.

Omaha, Neb.—An ordinance was introduced February 13 providing for asphalt paving on Maple street from Twentieth to Twenty-fourth streets. The property owners on Hamilton street from Twenty-ninth to Fortieth streets have expressed a desire for paving.

Chicago, Ill.—The property owners in Forty-fifth and Forty-sixth streets, between Grand Boulevard and Cottage Grove avenue, and in Forty-fifth Place, oppose the repaving of these thoroughfares, claiming that repairs are all that is necessary.

Peoria, Ill.—Estimates have been received for paving Washington street from Western avenue to Krause avenue, and the hearing was set for February 26. An ordinance has also been signed for paving Crescent avenue with brick.

Battle Creek, Mich.—At a meeting of the good roads committee of the Business Men's Association it was decided to go ahead with the work and to make the first experiment in building a road between this city and Bellevue.

Cincinnati, O.—The Board of Public Service says a $1,000,000 bond issue is necessary for the repair of macadam and bowlder streets, and a resolution was passed February 8 to petition the Legislature for authority to provide it.

Davenport, Ia.—Asphalt paving has been decided upon for Division, Eighteenth, Scott, Caines, Ripley, Prady, and Seventh streets; brick for Rock Island, High, and Second streets; telford for Grand avenue; creosoted block for Second street from Perry to Main.

St. Paul, Minn.—The residents of Carroll street, between Rice and Western, have secured the postponement for a few weeks of the boulevarding proceedings, so that the street may be macadamized at the same time it is boulevarded.

Walla Walla, Wash.—City Council has decided to create an assessment district for fifty blocks of paving in addition to the contracts that have already been awarded for Spokane and W. Main streets. Warren's bitulithic paving is favored.

Norfolk, Va.—The construction of a boulevard from this city to the exposition grounds, a distance of about seven miles, is contemplated by City Councils and the County Board of Supervisors, who will co-operate in the work. Frank Hitch, chairman committee.

Oberlin, Kan.—Bids, with specifications, are invited by the citizens representing 100,000 feet of residence and 50,000 feet of business districts, from cement, vitrified brick, and stone contractors, for constructing sidewalks. Address Joseph H. Young.

Murphysboro, Ill.—Special. George Kennedy, Jr., city engineer, says Council has under consideration the purchase of a steam road-roller and has instructed the Board of Public Improvements to make estimates of paving eight or ten streets and prepare an ordinance.

Fond du Lac, Wis.—Council has authorized the construction of 20,000 square yards of tar macadam and 13,000 linear feet combined curb and gutter this spring. About 15,000 square yards of brick paving and 7,000 feet of curb and gutter will also be ordered at the next meeting. G. H. Stanchfield, city engineer.

Suffolk, Va.—Plans and specifications are being made for improving various streets. Bitulithic paving will be constructed on the principal streets, but different kinds of material are proposed for the remainder of the streets. About 2,000 linear feet of curbing will be required. Lee Shafer, city engineer.

Atlantic City, N. J.—Council voted unanimously February 12 in favor of paving Atlantic avenue with bitulithic. Two former contracts for paving the thoroughfare with asphalt had been set aside by the courts as illegally granted. Petitions for the bitulithic paving were presented to Council by merchants and residents on the street, the Hotel Business Men's Association, and the Business Men's League.

Utica, N. Y.—Resolutions were passed Feb. 16 for paving 35 streets.

Allentown, Pa.—An ordinance has been passed for paving Turner st. from Jefferson to 18th.

San Francisco, Cal.—Specifications have been approved for paving Mission st. from 6th to 9th with asphalt.

Ottawa, Kan.—A resolution has been passed for paving 4th st. from Walnut to Willow with vitrified brick.

St. Louis, Mo.—A hearing will be given March 9 on the proposed improvement and reconstruction of 34 streets.

Buffalo, N. Y.—The street commissioners voted, Feb. 21, to pave Oneida st. from Emslie st. to Filmore ave. with stone.

Geneseo, Ill.—Bids will probably be asked for about April 10 for 100,000 sq. ft. of cement sidewalks. C. O. Harper, cy. clk.

Salt Lake City, Utah.—Mayor Thompson signed an ordinance Feb. 15 for paving Second South st. from Third East to Tenth East st.

Baltimore, Md. — The Walbrook Land Corporation is completing plans and specifications for paving the streets in Walbrook with macadam.

Brookfield, Mo.—Resolutions have been passed providing for vitrified brick paving on Main st. from Clarke to Canal. Chas. K. Hart, cy. clk.

St. Paul, Minn.—The city clerk has been directed to advertise for bids for macadamizing Edgerton st. from Maryland st. to northern city limits.

CONTRACTS TO BE LET.

Moline, Ill.—Bids will be asked about March 1 for asphalt paving. Clark G. Anderson, city engineer.

Troy, O.—Bids will be asked about March 1 for five blocks of brick paving. H. G. Walker, city engineer.

Corning, N. Y.—Sealed bids are asked until March 15 for laying about 4,625 feet of brick paving. B. P. W.

Versailles, Ind.—Bids are asked until March 6 for constructing eight miles of macadam roads in Shelby township. County commissioners.

Great Falls, Mont.—Bids are asked until March 5 for repairing a portion of Central avenue. W. P. Wren, city engineer.

Cleveland, O.—Bids are asked until March 7 for grading a section of Granger road. Julius C. Dorn, clerk Board of County Commissioners.

Decatur, Ind.—Bids are asked until March 5 for constructing gravel roads in Kirklin and Washington townships. C. D. Lawton, county auditor.

Rockville, Ind.—Bids are asked until March 5 for constructing gravel roads in several townships. Henry Grubb, county auditor.

Leavenworth, Wash.—Bids are asked until April 2 for clearing, grubbing, grading, and surfacing State Road No. 3. County commissioners.

Geneseo, Ill.—Bids will be asked about April 10 for constructing 100,000 square feet of cement sidewalks. C. O. Harper, city clerk.

Sterling, Ill.—Bids will be received about March 15 for paving East and West Third and Locust streets with brick. John B. Lewis, mayor.

Peekskill, N. Y.—Bids are asked until March 15 for constructing 2.18 miles of telford and macadam road. S. Allen Mead, town clerk.

Madison, Ind.—Bids are asked until March 8 for constructing 3,352 feet of macadam road in Madison and Hanover townships. C. F. Crozier, county auditor.

Valparaiso, Ind.—Sealed bids are asked until March 5 for constructing gravel roads in Center, Porter, and Liberty townships. Stephen P. Corboy, county auditor.

Cobleskill, N. Y.—Bids are asked until March 19 for paving several streets with brick or macadam and constructing sewers in same. Wm. H. Golding, village clerk.

St. Paul, Minn.—Bids are asked until March 5 for constructing a macadam road on the New Brighton road from Lexington avenue to Crossley road. E. G. Krahmer, county auditor.

Montgomery, Ala.—Sealed bids are asked until March 5 for paving Mildred street from Holcombe to Amanda streets with vitrified brick. R. S. Williams, city treasurer.

Bay City, Mich.—Bids are asked until March 5 for paving certain streets with asphalt, vitrified brick and Warren's bitulithic. G. Hine, chairman Board of Public Works.

Des Moines, Ia.—Bids are asked until March 2 for 30,000 square yards of asphalt paving, and until March 3 for paving Carpenter avenue with asphalt. W. W. Wise, chairman Board of Public Works.

Los Angeles, Cal.—Bids are asked until March 16 for furnishing 8,000 to 10,000 barrels of Portland cement. United States Reclamation Service, Union Trust building; E. A. Hitchcock, secretary Department of the Interior, Washington, D. C.

New York city.—Bids are asked until March 6 for regulating and macadamizing 7,100 square feet of Sheepshead Bay road and Jerome avenue. Geo. B. McClellan, Herman A. Metz, W. B. V. Bennett, commissioners common lands fund of Gravesend.

Atlanta, Ga.—Bids are asked until March 5 for constructing the South Boulevard underpass, consisting of 1,500 cubic yards of concrete, 9,000 cubic yards of excavation, and 1,700 square yards of granite paving. R. M. Clayton, city engineer.

Lake Charles, Ia.—Setaed bids are asked until March 20 for constructing 26,000 square yards of paving, the bids to include all necessary earthwork and drainage-pipe installation. Frank Shutts, city engineer; C. H. Winterhaler, mayor.

Pentwater, Mich.—Bids are asked until 2 p. m. March 17 for grading and macadamizing one and three-fourths miles of stone road in Shelby township. The township furnishes the stone and has a crushing plant. Geo. E. Dewey, commissioner, Shelby, Mich.; F. F. Wetmore, engineer, Pentwater.

Crookston, Minn.—Bids are asked until March 13 for paving Houston avenue from Ash street to Carman bridge with asphalt, requiring the following: Asphalt, 6,818 square yards; three-inch tile drain, 3,578 linear feet; artificial combined curb and gutter, 2,441 linear feet. J. E. Carroll, city engineer.

CONTRACTS AWARDED

Lawrence, Kan.—Hoskins & Ramsey, of Topeka, secured the contract for improving several streets.

Portland, Conn.—Samuel Nelson secured the contract for grading 1,800 feet of roadway for $2,400.

Milwaukee, Wis.—Contracts for resurfacing two streets have been awarded to Mark Lee, at $1.43 a square yard.

Rhinelander, Wis.—T. J. McGrath was awarded the contract for macadamizing several streets for $14,676.

Dallas, Tex.—The contract for 5,294 square yards of vitrified brick paving was awarded to C. W. Olcott for $11,327.

Roanoke, Va.—The Southern Contracting Company, of Norfolk, Va., was awarded the contract for street paving for $40,000.

Buffalo, N. Y.—The contract for paving a section of Curtis street with asphalt was awarded to H. P. Burgard for $37,513.

Steelton, Pa.—The contract for paving Front street with wood blocks was awarded to the United States Wood Preserving Company, of New York city.

Boise, Idaho.—The Warren Construction Company was awarded the contracts for constructing eighteen blocks of bitulithic paving, February 8, at $2.25 a square yard.

Columbus, Ga.—The contract for 30,000 square yards of bitulithic paving has been awarded to the Southern Bitulithic Company, of Nashville, Tenn.

St. Louis, Mo.—The contract for furnishing 50,000 granite blocks was awarded to M. V. Lowe, of Sioux Falls, S. Da., at $49.50 per thousand.

Galveston, Tex.—H. K. McCullum, of Fort Worth, was awarded the contract for paving the Sea-Wall Boulevard with vitrified brick for $1.40 a square yard.

Tacoma, Wash.—The Lister Construction Company was awarded the contract for grading and sidewalks on M street from Center street to Bridge No. 17, for $1,180.

Joliet, Ill.—The contracts for paving Hickory street and Fourth avenue with asphalt was awarded to the R. F. Conway Paving Company, of Chicago, at $2.10 a square yard.

New Albany, Ind.—The contract for paving Vincennes street with vitrified brick was awarded to the Marion Construction Company, of Indianapolis, for $60,000.

Little Rock, Ark.—Contracts for paving thirty-eight blocks of streets with vitrified brick were awarded February 14 to L. P. Shelby and J. H. McCoppin, for $170,000.

Niagara Falls, N. Y.—The contract for paving Niagara street with asphalt blocks was awarded February 18 to the International Paving Company, of Utica, at $2.45 a square yard.

Harrisburg, Pa.—The Barber Asphalt Paving Company has been awarded the contract for paving two streets with asphalt at $1.77 a square yard, and 98 cents a linear foot for granite curbing.

Winchester, Ind.—Moorman & Goodrich secured the contract for paving Main, Meridian, Washington, Franklin, and Railroad streets and an alley with Metropolitan brick, at $1.93 to $2 a square yard.

Atchison, Kan.—The Atchison Crushed Stone Company was awarded the contract for paving R street at $1.29 a square yard, and the contract for paving Q street was awarded to L. Wines & Co., at $1.21½ a square yard.

Jersey City, N. J.—The Uvalde Asphalt Paving Company, 16 Broadway, New York city, was awarded the contract for 4,896 square yards of asphalt paving on Oxford avenue, February 3, at 84 per cent. of the standard cost.

Kansas City, Mo.—The contract for macadamizing Lee's Summit and Greenwood roads was awarded February 10 to John H. Brizendine, of Lee's Summit, at $1.25 a cubic yard for macadam; bridge masonry, $5; culvert masonry, $4.

St. Paul, Minn.—The contract for macadam paving on Lexington avenue was awarded to J. M. Thornton for $16,195. The St. Paul Cement Works was awarded the contract for building cement sidewalks during the coming season for $15,268.

Peoria, Ill.—J. S. Allen was awarded the contract for paving Linn street with brick, in two sections, for $1,429.98 and $5,152.72, respectively; and John McAllister secured the contract for brick paving on Western avenue for $1,905.44.

Baltimore, Md.—Contracts for furnishing 300,000 asphalt blocks were awarded to the Maryland Paving Company for $151,000; vitrified brick, Wm. W. Clarke & Son; vitrified sewer pipe, Wm. W. Clarke and Son and the Baltimore Terra Cotta Company.

Worcester, Mass.—Contracts for furnishing curbing and paving blocks have been awarded as follows: Webb Granite Construction Company, of Worcester, curb, 53 cents a foot; circular curb, $1.10; round corners, $3.50 each. Mitford Quarry and Construction Company, Nashua, N. H., paving, $1.55 a square yard.

Columbus, O.—Paving contracts were awarded February 2 as follows: Eureka avenue, to the Cleveland Trinidad Paving Company, at $9,557; Michigan avenue, to N. B. Abbott, at $8,906; Capitol street, to W. H. Luchtenberg & Co., at $6,265; Maple street, to Geigele & Garnes, at $5,927.

Buffalo, N. Y.—Special. The contract for repaving Park street between Virginia and Allen streets, and Whitney Place between Maryland and Hudson streets, with asphalt was awarded to the German Rock Asphalt and Construction Company, for $3,505 and $2,760, respectively. The Gantz-Wilson Construction Company was awarded the contract for paving Northampton street between Ruhland and Metcalfe streets, for $6,453. Bids were received February 19 for paving a large number of streets, but the contracts have not yet been awarded.

Philadelphia, Pa.—Contracts for paving during the year were awarded February 2 as follows: For repairs to cobble, rubble, vitrified brick, asphalt block, slag block, and setting crossing stones, to Mack Paving Company, $80,000; repairs to granite block, to Cunningham & Murray, $5,000; repairs to granolithic, Edward Ryan, $10,000; repairs to unpaved macadamized roads, D. Mahon, $136,800; repairs to asphalt streets, Filbert Paving Company, Fifteenth and Chestnut streets, $20,000. A. Lincoln Acker is director of public Works.

SEWERS.

Baltimore, Md.—The sewerage commission has decided to use the alleys as far as it is possible in building sanitary sewers.

Albany, N. Y.—The State Department of Health has received protests from the villages of Oxford and Greene against the village of Norwich emptying its sewers into the Chenango River.

New York City.—The New York Sewage Disposal Company, 1 Madison avenue, has been incorporated to construct sewage disposal and purification plants, by Geo. L. Robinson, Edward L. Wagner, of 1 Madison avenue, New York city, and Francis J. Byrne, 1610 Fiftieth street, Brooklyn.

Chicago, Ill.—The United States supreme court at Washington decided that Chicago's drainage canal does not pollute the waters of the Mississippi River to any appreciable extent. The decision will be given more fully in the next issue of MUNICIPAL ENGINEERING.

CONTEMPLATED WORK.

Howard, S. D.—A sewerage system is contemplated.

Webster, S. D.—A sewerage system is proposed.

Prosser, Wash.—A sewerage system is contemplated.

Des Moines, Ia.—The northwest portion of this city wants a septic sewer system.

Champaign, Ill.—The construction of a storm sewer is contemplated.

Findlay, O.—Bids will be asked soon for constructing the N. Main st. sewer.

Binghamton, N. Y.—S. M. Baird, cy. engr., estimates the cost of the Fourth ward sewer at $105,000.

Winnebago City, Minn.—A survey has been made for a sewerage system here.

Troy, N. Y.—The estimated cost of the proposed Pawling ave. sewer is $14,611. E. B. Cary, cy. engr.

South Omaha, Neb.—This city voted to issue $250,000 bonds for the construction of a sewerage system.

San Francisco, Cal.—Plans have been submitted for constructing the proposed Upper Sunset main sewer.

Guyandotte, W. Va.—The question of issuing $50,000 bonds for sewerage will be voted on April 14.

Nashville, Tenn.—The sum of $5,100 has been appropriated for sewer construction. W. W. Southgate, cy. engr.

Joliet, Ill. — An ordinance has been passed providing for a sewer in Chicago st. from Hickory creek to 5th ave.

Merchantville, N. J. — The borough Council has adopted plans for a sewerage system. A. W. MacCullum, chmn. sewer com.

Quincy, Mass.—The extension of the main and lateral sewers, at a cost of $20,000, is under consideration.

St. Paul, Minn.—The Board of Public Works voted to make a favorable report on the proposed sewer system for Warrendale.

Zanesville, O.—An ordinance has been passed for constructing a storm sewer in N. 7th st. Bids will be asked soon.

Taunton, Mass.—About 3,000 ft. of 40-in. and 20,000 ft. of smaller sewers will be constructed. A. K. Crandell, cy. engr.

New Haven, Conn.—The construction of overflow sewers in the central part of the city is contemplated. C. W. Kelly, cy. engr.

Aberdeen, S. D.—The question of issuing $75,000 bonds for the construction of a sewage disposal plant will be voted on March 8.

St. Marys, O.—Bonds have been authorized to the amount of $75,000 for constructing a complete sanitary sewerage system.

Madison, Wis.—Bids will be asked about April 1 for constructing 6 mis. of concrete and vitrified pipe sewers. John Icke, cy. engr.

McPherson, Kan.—Plans and specifications will be prepared for a sewer system in the first sewer district. H. A. Rowland, cy. engr.

Ashtabula, O.—The property owners on Cherry and Baker sts. have petitioned for sewers. Bids will be asked for building sewers on Camp st.

Roanoke, Va.—Plans and specifications have been prepared and bids will be asked soon for improving the Campbell ave. drain. W. B. Bates, cy. engr.

Evansville, Ind.—An agreement has been reached whereby the Board of Public Works will construct the Kentucky ave. drain. Cy. Engr. Saunders.

Arkadelphia, Ark.—R. R. Huie, John Brown and J. M. Adams have been appointed a committee to investigate the question of installing a sewerage system.

Boston, Mass.—The Board of Aldermen has adopted a loan order of $600,000 for constructing sewers in connection with the metropolitan system.

Lewiston, Ida.—A reoort has been submitted to Council by Miller & Graves, engrs., showing the cost of the proposed sewerage system to be about $99,700.

Camden, N. J.—An ordinance has been passed for constructing a sewer in Mt. Epworth ave., Lemon and Louis sts. to Newton creek. Harry C. Kramer, cy. clk.

Los Angeles, Cal.—An ordinance is being prepared providing for a special election to vote on the issue of bonds for new sewers, bridges and storm drains.

Springfield, O.—W. H. Sieverling, cy. engr., has been directed to prepare profiles and estimates of the cost for constructing the North and Shaffer st. sewers.

East St. Louis, Ill.—The ordinance providing for the construction of a sewer at a cost of $758,000 has been sustained by Judge Dunnegan, of the City Court at Alton.

Atlantic City, N. J.—Gravity drainage, with a pumping system, is proposed for Atlantic ave. to take the place of the cesspool pipe syphon plan that has been proposed.

Grundy Center, Ia.—E. A. Crary has been directed to draft a resolution for constructing a new sewerage system, and the question of building will be voted on in March.

Palmyra, N. Y.—The village trustees will ask the Legislature to provide means for constructing a sewerage system by amending the charter so that the question can be voted on.

Salt Lake City, Utah.—A resolution has been adopted directing the Board of Public Works to ask for bids for constructing sewers, water mains, sewer laterals and cement sidewalks for the year 1906.

San Diego, Cal.—Plans and specifications have been approved and bids will be asked for constructing a reinforced concrete storm sewer in B st. G. A. D'Hamecourt, cy, engr.

Winchester, Va.—A bill has been introduced in the Legislature providing for a special election to vote upon the issue of $50,000 bonds for building a sewerage system. Plans have been prepared.

Brockton, Mass. — This city contemplates the construction of 4 mis. of pipe sewers at a cost of $40,000 and the construction of surface drainage system at a cost of $10,000. Chas. R. Felton, cy. engr.

Cleveland, O.—The Board of Public Service has been given permission, through Robert Shaw Oliver, assistant secretary of war, to build the outlet section of the intercepting sewer out into the lake.

Oil City, Pa.—The construction of a sewerage system at a cost of $48,000 is contemplated. Plans and specifications were to be on file at the office of the city engineer, E. S. Lawrence, after Feb. 26.

Charleston, S. C.—The completion of the sewerage system is desired, and the City Council has asked for a report upon the cost of the completion of the remaining work in the First district and the extension of the system over the entire city.

Murphysboro, Ill.—Special. Geo. Kennedy, Jr., says the County Court confirmed Feb. 19 the assessment for the West Side sewer system, consisting of about 5 mis. of sewers, with manholes, flush tanks, etc. The contract will be let as soon as it can be properly advertised.

Philadelphia, Pa.—Special. J. D. Harris, 6063 Greenway ave., advises us that he is accepting bids for labor and material required for three municipal plants, each to include sewers, gas and water. For the sewers he requires pipe, cement, manhole covers, catch basins and inlets.

CONTRACTS TO BE LET.

Salem, O.—Bids are asked until March 6 for building a sewer in Jennings ave.

Emmetsburg, Ia.—Bids are asked until March 5 for building a sewer. P. H. Hand, cy. clk.

Crookston, Minn.—Bids are asked until March 25 for constructing a ditch. John Eid, co. audt.

Sac City, Ia.—Bids are asked until March 5 for constructing tile drains. J. J. Harter, co. audt.

Bay City, Mich.—Bids are asked until March 5 for constructing a sewer in Chilson ave. G. Hine, chmn. B. P. W.

Crookston, Minn.—Bids are asked until March 13 for 3,578 lin. ft. of 3-in. tile drains. J. E. Carroll, cy. engr.

Garner, Ia.—Bids are asked until April 2 for constructing ditches and drains in district No. 19. Geo. Asplin, co. audt.

Madison, Wis. — Bids will be asked about April 1 for 6 mis. of concrete and vitrified pipe sewers. John Icke, cy. engr.

Green Bay, Wis.—Bids are asked until March 26 for constructing 4,400 ft. of brick and 4,.00 ft. of pipe sewers. W. W. Read, cy. engr.

Libertyville, Ill.—Bids are asked until March 9 for constructing a sewage purification plant and outlet sewer. W. C. Sanborn, vil. clk.

Woodstock, Vt.—Bids are asked until March 15 for building about 20,000 ft. of 8-in. vitrified pipe sewer. Fred Chapman, clk. vil. trustees.

Apalachicola, Fla.—Bids are asked until March 20 for constructing 2½ to 3 mis. of 6 to 12-in. sewers, with manholes, etc. M. Brash, ecy. B. P. W.

Jacksonville, Fla.—Bids are asked until March 5 for constructing c. i. and terra cotta sewers and brick and terra cotta drains. B. F. Dillon, chmn. Bd. Trustees.

Gainesville, Fla.—Sealed bids are asked until March 7 for constructing a sanitary sewerage system embracing 12 mis. of pipe sewers. W. W. Hampton, secy. B. P. W.

Des Moines, Ia.—Bids are asked until March 3 for constructing 575 ft. of vitrified clay pipe sewer on Davies ave. from 14th to 15th aves. W. W. Wise, chmn. B. P. W.

Toronto, Ont.—Bids are asked until March 6 for constructing sewers, pumping stations, septic tanks and bacteria beds for a system of sewerage east of Woodbine ave. Emerson Coatsworth, mayor.

Norwood, O.—Sealed bids are asked until March 10 for constructing a sanitary sewer in the easement granted by the Baltimore & Ohio Southwestern Railway Co. from Forest ave to 3,400 ft., more or less, west. W. H. Perry, prest. B. P. S.

CONTRACTS AWARDED.

Redding, Cal.—The contract for furnishing sewer pipe was awarded Feb. 5 to the James Young Hardware Co. for $7,250.

Oak Park, Ill.—The contract for constructing a sewerage system in Randolph st. was awarded to E. A. Barker & Son for $6,745.

Akron, O.—A contract for constructing a sewer from the boulevard in South Akron to Bowery st. was awarded to Hallinan Bros. for $40,000.

Tacoma, Wash.—The contract for constructing sewers in Alliance addition was awarded Feb. 10 to Pellegrin & Ricca for $5,997.75.

Mohawk, N. Y.—Bids for constructing 5 mis. of sewers in this village were received Feb. 17 from sixteen contracting firms. They were as follows: E. E. Kelly, Herkimer, $39,997.60; De Nallo & Klingberg, Kingston, $38,280.18; McNamee & Rice, Kingston, $37,890; Donegan & Redmond, Brooklyn, $34,141.76; Nicholas Peters, Utica, $48,706; John Webber & Sons Construction Co., New York, $34,265.10; Cameron-Hawn Realty Company, Albany, $39,000; Burt-Kasson Construction Company, Gloversville, $31,819.73; Geo. S. Miller & Co., Oneida, $37,480; F. E. Spinner, New York, $34,250; Besch & Beebe, Utica, $34,824.65; Daniel J. Conroy, Oneida, $44,441.10; T. H. Gill & Co., Boston, $59,776.72; C. R. Lewis, Ilion, $37,384.10. Chas. D. Beckwith, of Schenectady, had a sealed copy of the proposition and certified check for $1,000, but failed to state the total amount of his bid.

Albany, N. Y.—The contract for repairing the Menands sewer was awarded Feb. 13 to the W. L. McDonough Construction Co., of Troy, for $4,974.60.

Rochelle, Ill. — Special. The contract for constructing a sanitary sewerage system embracing 10.4 mis. of sewers was awarded Feb. 15 to G. Maffioli, of Rockford, for $40,814, to the Iowa Engineering, Co., Clinton, Ia., engrs.

WATER WORKS.

Indianapolis, Ind. — The Pennsylvania Water Co., of this city, has been incorporated by C. L. Taylor, Wm. A. Kelly and R. T. Snapp.

Alton, Ill.—The Alton water works has been sold to a syndicate of manufacturers of this city, and the new owners will ask for a franchise.

CONTEMPLATED WORK.

Island City, Ore.—A water-works system is contemplated.

St. Joseph, Mo.—The extension of water mains is contemplated.

Fremont, Neb.—The extension of the water system is proposed.

Montezuma, Ia.—This city voted $5,000 additional bonds for securing a pure water supply.

Brundidge, Ala.—Plans and specifications are being prepared for a water-works system.

Haddonfield, N. J.—This city will vote on the question of issuing bonds for a new water plant.

Winona, Minn.—The water department contemplates installing a number of additional water meters.

Chillicothe, Mo.—This town voted in favor of municipal ownership of its water and light plants.

Barberton, O.—The Board of Public Affairs contemplates installing meters in different parts of the city.

Brandon, Minn.—All bids for constructing a water-works system were rejected. J. C. Metcalf, recorder.

Hornellsville, N. Y.—A 20-in. water main from the reservoir to the filter plant is contemplated. Water bd.

Grass Valley, Cal.—The extension of the water mains in south and southwestern Grass Valley is contemplated.

Bloomington, Ill.—The construction of water mains on certain streets is proposed. Elmer Folsom, cy. engr.

Quincy, Mass. — Council contemplates expending $25,000 for extensions to the water system. Hamilton Flood, cy. engr.

Dunkirk, N. Y.—The Board of Water Commissioners has decided to expend $10,000 in extending the water mains to the Fourth ward.

Aurora, Minn.—This village will vote March 13 on the issue of $8,500 bonds for water-works and other improvements.

Madison, Wis.—This city will be ready soon for estimates for a concrete water reservoir. J. B. Heim, supt. w. w.

Laramie, Wyo.—The question of issuing $80,000 bonds for rebuilding the water system in this city will be voted on March 20.

Webster, Mass.—The town commissioners contemplate laying a new 10-in. pipe direct from the pumping station through E. Main st.

Orange, N. J.—Common Council adopted Feb. 19 the plan of Rudolph Hering for improving the water system. Fred T. Crane, cy. engr.

Gilbertsville, N. Y.—The question of

expending $2,300 for water-works improvements will be voted on. Chas. P. Root, prest. village.

Albia, Ia.—Special. This city has voted to issue $40,000 bonds for building a water-works system. C. R. Allen, cons. engr., Ottawa.

Lawrence, Mass.—Bids will be asked for the purchase of 3,000 ft. of 6-in. and 1,000 ft. of 8-in. c. i. pipe. M. F. Collines, supt. water dept.

Holton, Kan.—The estimated cost of a water-works system for this city, including 2 mis. of sewers and an electric-light plant, is $79,000.

Albany, N. Y.—Plans for an addition of 2½ acres of filter beds to the present filter plant are being prepared by Walter Greenalch, engr.

Montpelier, Ida.—The City Council has authorized the employment of an engineer to make plans for installing the proposed water-works system.

Wessington Springs, S. D.—Council will take action March 5 toward securing the services of a civil engineer to make plans for a water-works system.

Fostoria, O. — Council has authorized the Board of Public Service to employ Riggs & Sherman, of Toledo, as consulting engineers on the proposed improvement to the water supply.

The question of issuing bonds for the construction of water-works systems has been favorably voted on at the following places: Walla Walla, Wash.; Weston, Neb.; Clinton, Mo.; Perry, Fla.

Wheeling, W. Va.—Council committee on water works will ask Council for authority to ask for bids for a new pumping engine and other improvements at the pumping station not to exceed $150,000.

Philadelphia, Pa.—Special. J. D. Harris, 6063 Greenway ave., advises that he is interested in accepting bids for a municipal water plant, requiring tanks, towers, pump, engine, c. i. pipe, fire plugs, valves, etc.

Kewanee, Ill.—Estimates for three different systems of water works have been submitted by Daniel W. Mead, of Chicago, as follows: Shaft proposition, $55,000; centrifugal pump system, $35,000; air lift system, $28,000.

Ironton, O. — Special. D. H. Clark, supt. Ironton City Water Works, advises us that this city contemplates extensive improvements in the water-works system and the installation of a municipal lighting plant in connection with the same.

The construction of water-works systems is contemplated in cities and towns as follows: Hastings, Minn.; Eunice, La.; Julietta, Ida.; Freewater, Ore.; Highmore, S. D.; Russellville, Ark.; Punta Gorda, Fla.; Grano, N. D.; Tower, N. D.; Toluca, Ill.; Marcellus, N. Y.; Sayre, O. T.; Franklin, Va.; Chetek, Wis.; Vinton, O.; Munhall, Pa.

CONTRACTS TO BE LET.

Parkbridge, Ill.—Sealed bids are asked until March 6 for constructing a water tower. Vil. clk.

Fargo, N. D.—Bids are asked until March 5 for constructing a 6-in. water main in 10th st. H. J. Gibson, cy. audt.

Apalachicola, Fla.—Bids are asked until March 20 for constructing a water-works system. M. Brash, secy. B. P. W.

Arcadia, Fla. — Bids are asked until March 17 for constructing a water-works system. J. T. Youmans, chmn. bond trustees.

Meaford, Ont.—Bids are asked until March 6 for supplying steam pump, pipes, valves, boiler, etc. George G. Albery, town clk.

Washington, D. C. — Sealed bids are asked until March 3 for furnishing 600 tons of 8-in. c. i. water pipe. H. B. F. MacFarland, chmn. Dist. Comrs.

Richmond, Va.—Bids are asked until March 14 for constructing a steel reinforced concrete conduit about 1 mi. long and 5 ft. in diameter, with connections. Chas. E. Bolling, supt. w. w.

CONTRACTS AWARDED.

Cincinnati, O.—The contract for the new Western Hills pumping station was awarded to Chas. J. Glose, of Columbus, for $51,920.

Lone Tree, Ia.—The contract for constructing a water-works system was awarded to G. H. Meredith, of Cedar Rapids, for $8,678.

Irondequoit, N. Y.—The contract for constructing a water system from Lake Ontario was awarded to the Rochester and Lake Ontario Water Co.

Jacksonville, Fla.—The C. H. Wheeler Condenser and Pump Co., of Philadelphia, was awarded the contract for two surface condensers, Feb. 5, for $7,490.

New Orleans, La.—The contract for constructing and erecting 21 cisterns at Jackson Barracks was awarded to H. F. Lewis & Co., Ltd., of this city, for $3,300.

BRIDGES.

Burnet, Tex.—Burnet county voted to build three steel bridges.

Seattle, Wash.—City Council passed an ordinance to build a bridge at Alva st.

Petersburg, Ind.—Bids are asked until March 7 for building a steel bridge over White river.

Racine, Wis.—Plans have been adopted for a swing bridge at Main st. to cost $67,000.

Kingston, Mo.—Bids are asked until March 6 for building six small bridges. S. C. Rogers, co. surv.

Olivet, S. D.—Bids are asked until April 3 for building a number of bridges across James river.

Washington, Ind.—Bids are asked until March 6 for constructing a steel and concrete bridge. H. H. Sefrit.

Leavenworth, Kan.—Bids are asked until March 5 for building a number of bridges. J. W. Niehaus, co. clk.

Binghamton, N. Y.—Bids will be asked soon for repairing the Court st. bridge at a cost of about $70,000.

Pine Bluff, Ark.—Bids will be asked soon for building a steel bridge over the Arkansas river. Jesse R. Core, co. clk.

Martinton, W. Va.—Bids are asked until March 6 for building a steel bridge over Stamping creek. S. L. Brown, co. clk.

Belleville, Ill. — Plans are being prepared for a reinforced concrete bridge across Richland creek. L. L. Harper, cy. engr.

Truckee, Cal. — Bids are asked until April 4 for constructing a trestle bridge across Trout creek here. F. S. Arbogast, co. clk.

Birmingham, Ala.—Bids are asked until March 3 for constructing seven steel bridges in various parts of the county. P. S. Milner, co. engr.

Newport, Ind.—Bids are asked until March 12 for constructing a steel high-

way bridge across Wabash river at Cayuga. W. T. Sanders, chmn.

Loup City, Neb.—Bids are asked until March 6 for constructing all bridges that may be needed in this county this year. C. F. Beushausen, co. clk.

Montreal, Que.—Bids are asked until March 12 for building a steel bridge at Cap Rouge for the Grand Trunk Pacific Ry. Co. Joseph Hobson, ch. engr., Montreal.

Boston, Mass.—Bids are asked until March 5 for constructing a Scherzer rolling lift bridge. Henry S. Pritchett, chmn. Charles River Basin Commission, 367 Boyiston st.

Providence, R. I.—Bids are asked until March 7 for a steel superstructure to replace the present fixed spans of the Point st. bridge over Providence river. Walter F. Slade, comr. pub. wks.

Bay City, Mich.—Sealed bids are asked until March 12 for constructing an abutment pier at the west end of the fixed span over the east channel of the Lafayette ave. bridge. D. F. Kinney, chmn. Bay Co. Bridge Comrs.

Port Huron, Mich.—Bids will be received March 15 for building a new bridge across Black river at Military st. Two stiles, a jack-knife and a counter-balance bridge will be considered. Bids are asked until March 30 for a bascule and a counter-balance bridge. R. D. O'Keefe, supt. pub. wks.

Custer, S. D.—Bids are asked until April 3 for building a steel bridge over French creek. W. A. Nevin, county auditor.

Minneapolis, Minn.—Bids are asked until March 5 for work on bridges Nos. 19, 21, 264, and 279. Hugh R. Scott, county auditor.

STREET LIGHTING.

Seward, Neb.—The capacity of the electric-light plant will probably be doubled.

Clinton, Mo.—This city voted Feb. 15 to issue bonds for constructing a municipal lighting plant.

Kearney, Neb. — A franchise for an electric light and power plant has been granted J. H. Davis & Son.

Osawatomie, Kan.—Bids are asked until April 1 for constructing an electric-light plant. W. H. Murphy, supt.

Crookston, Minn.—Bids are asked until March 6 for installing a light plant at the county jail. Bd. Co. Comrs.

Omaha, Neb.—The city clerk was directed Feb. 13 to readvertise for bids for lighting the gasoline district.

Vinton, O.—Estimates on the cost of erecting an electric-light plant are desired. W. C. Feltman, vil. clk.

Milwaukee, Wis. — Mayor Rose has signed the ordinance to issue $250,000 bonds for a municipal electric-light plant.

Ennis, Tex. — A franchise has been granted W. A. Ross, of Los Angeles, for constructing a gas plant to cost $25,000.

Fort Wood, N. Y. H.—Bids are asked until April 16 for constructing an electric light and power system. G. C. Burnell, Const. Q. M.

Wynnewood, I. T.—The time for receiving bids for constructing an electric-light and water-works plant has been extended to March 10. J. O. Swingley, mayor.

Philadelphia, Pa.—Special. J. D. Harris, 6063 Greenway ave advises us that he is interested in receiving bids for labor and material for a municipal gas plant, requiring holders, c. i. pipe and lamp posts.

Orange, N. J.—Bids are asked until March 5 for lighting the streets of this city with electricity for 3 and 5 years. Edward Cheetham, chmn. st. lighting com.; W. B. Gano, cy. clk.

Ironton, O.—Special. D. H. Clark, supt. Ironton city w. w., says this city contemplates the installation of a municipal lighting plant in connection with the water-works system.

Hyattsville, Md.—A bill has passed the House and is before the Senate authorizing the mayor and Council of this city to issue $12,000 bonds with which to install an electric-light plant.

Brookline, Mass.—This town voted to appropriate $35,000 for a consolidated heating, lighting and power plant to serve the public buildings. A. H. French, town engr.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Davenport, Ia.—The Scott County Garbage Reducing and Fuel Co. has been incorporated for removing and destroying garbage.

Auburn, N. Y.—Bids are asked until April 1 for the collection and disposal of garbage for a term of years. A. F. Hodgman, chmn. com.

Baltimore, Md.—Bids are asked until March 7 for selling or renting two flushing machines for use in the street-cleaning department. J. L. Wickes, comr. st. cleaning.

Shelbyville, Ind.—The Shelbyville Street Sprinkling Co. has been incorporated by Christian Able, Chas. P. Sidlinger, Chas. E. Plummer, Sylvan B. Morris and Jacob H. Dietzer.

Oswego, N. Y.—Bids are asked until March 22 for the construction of a crematory building and the construction and erection of a garbage crematory at Ft. Ontario. Lieut. Henry H. Hall, Constr. Q. M.

St. Louis, Mo.—Council passed an ordinance Feb. 14 authorizing the sanitary committee of the municipal assembly to visit Cleveland and Toledo, O., to investigate the garbage disposal system in use in those cities.

Newark, N. J.—The ordinance committee has been directed to report on every feature connected with garbage disposal—disposal of garbage, the erection of an incinerator and the utilization of garbage toward lighting the city alone or in combination with other municipalities.

FIRE APPARATUS.

Crookston, Minn.—Special. J. E. Carroll, cy. engr., advises us that the fire committee has been directed to have sanitary stalls put in the fire department headquarters.

Belleville, Ill.—Special.—Fred J. Kern, mayor, says this city will purchase the newest and best hose wagon equipments for two fire engine houses, and asks that dealers forward terms and other particulars.

Newark, N. J.—The fire commissioners voted Feb. 14 to ask the finance committee for an appropriation of $50,000 with which to install a central alarm system in the proposed new fire headquarters.

TOO LATE FOR CLASSIFICATION

Duluth, Minn.—Bids are asked until March 2 for building an alley sewer. Board of Public Works.

Lansing, Mich.—Bids are asked until March 5 for building sewers. H. A. Collar, city engineer.

Delaware, O.—Bids are asked until March 19 for improving Oak street. F. D. King, clerk Board of Public Service.

Wabash, Ind.—Bids are asked until March 12 for building a sewer in Miami street. Fremont McLees, city clerk.

Benson, Neb.—The contract for constructing a water-works system was awarded to Crane & Co. for $20,000.

Beckwith, Cal.—Plans are being discussed providing for the construction of a new water-works system here.

Sacramento, Cal.—Bids are asked until March 5 for 1,000 pieces of 6-inch c. i. pipe. M. J. Desmond, city engineer.

Donaldsonville, La.—Bids are asked until March 21 for improving the water-works system. Cahs. Marvin, mayor.

Spokane, Wash.—Plans have been completed for a large sewer district in the southeastern part of this city.

Des Moines, Ia.—Bids are asked until March 12 for grading West Twenty-sixth and West Twenty-fourth streets. W. W. Wise, chairman Board of Public Works.

Glendive, Mont.—Bids are asked until March 19 for constructing a water-works system. Hans J. Halvorson, city clerk.

St. Paul, Minn.—Bids are asked until March 5 for a 10-, 11- or 12-ton steam road-roller. Edw. G. Krahmer, county auditor.

Hot Springs, Ark.—Bids are asked until March 5 for about 27,000 square yards of street paving. Frank Ellsworth, city engineer.

Cortland, N. Y.—Plans have been submitted and approved for constructing a large number of sewers, at a cost of $147,000.

Muskegon, Mich.—Muskegon Heights voted, February 19, to issue $40,000 bonds for the construction of a water-works system.

Madison, Neb.—Bids are asked until March 20 for constructing and repairing bridges for the year. Geo. E. Richardson, county clerk.

Olivet, S. D.—Bids are asked until April 3 for constructing a number of steel bridges over James River. J. W. Wipf, county auditor.

Sidney, O.—Sealed bids are asked until April 1 for constructing several concrete culverts and 1 30-foot open concrete bridge. County commissioners.

Menominee, Mich.—Bids are asked until March 19 for 11,500 square yards of brick paving and 11,000 square yards of macadam paving. Albert Haas, city engineer.

Greenville, O.—Special. The water-works department advises us, under date of February 24, that it is in the market for cement, crushed stone, etc.

Holton, Kan.—City Council decided, February 16, to hold a special election in April to vote on the issue of $80,000 bonds for a water-works system.

Bradford, Pa.—Bids are asked until March 5 for constructing the Pine street bridge abutment and retaining wall along the creek. Edw. C. Charlton, city clerk.

Wichita, Kan.—The contract for paving the canal in Market street from Pine to English, was awarded to the Cleveland-Trinidad Asphalt Paving Company, at $1.54 a square yard.

Wheeling, W. Va.—Bids are asked until March 27 for furnishing 15,000 barrels of American Portland cement at dams 13 and 18, Ohio River. Geo. A. Zinn, major engineers.

Glendive, Mont.—Bids are asked until April 12 for furnishing 8,000 to 12,500 barrels of Portland cement. E. A. Hitchcock, secretary Department of the Interior, Washington, D. C.

Independence, Kan.—Sealed bids are asked until March 20 for grading, curbing and guttering 3,200 feet of Fourth street. Jos. S. Barnwell, city engineer; T. N. Sickles, city clerk.

Wilmington, Del.—The contract for furnishing a 12,000,000-gallon pumping engine for the new pumping system was awarded to the Holly Manufacturing Company, of Buffalo, for $79,769.

Pontiac, Mich.—The contract for paving South Saginaw street was awarded February 20 to Clancy & Ross, of Ann Arbor, at $1.56 a square yard. Logan block on concrete base will be laid.

Toledo, O.—Bids are asked until March 5 for paving Hamilton street with vitrified brick, asphalt, asphalt blocks, Medina block stone, or creosoted wood blocks. Frank Consaul, chief engineer.

Moline, Ill.—The contract for constructing the bluff sewer and water mains in the Fifth ward was awarded to the King-Lambert Construction Company, of Des Moines, Ia., for $38,738.

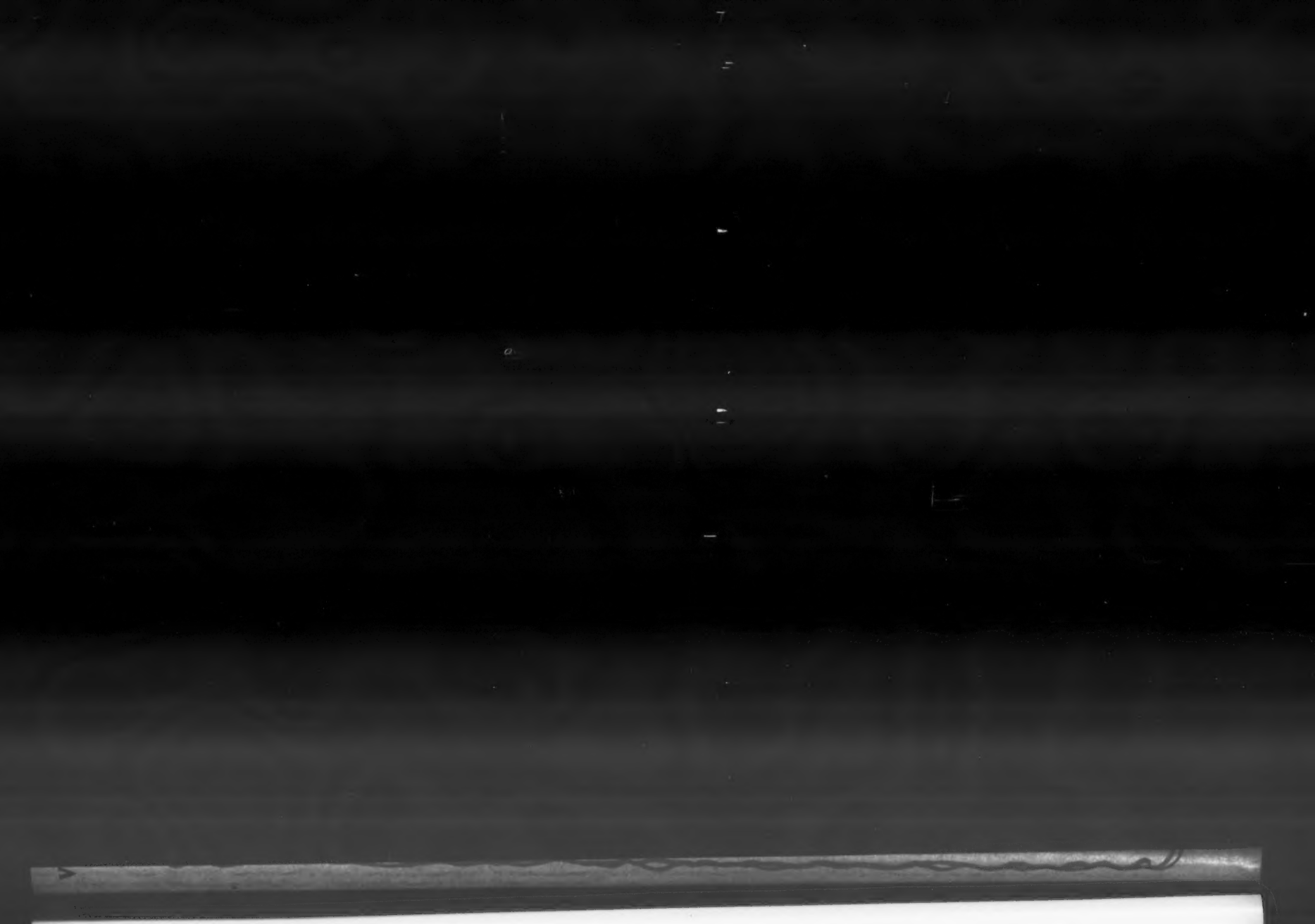
Marion, O.—A resolution has been adopted providing for the construction of stone walks on both sides of High street, and to build a sanitary sewer on Pennsylvania avenue from Church street to Indiana avenue.

Racine, Wis.—Sealed bids are asked until March 6 for removing the sub- and superstructure of the present bridge over Root River at Main street and building a new swing bridge and approaches. P. H. Connolly, chairman Board of Public Works.

New Orleans, La.—Sealed bids are asked until March 5 for paving Prytania street from Clio to Phillips with asphalt, and repaving Customhouse street from North Franklin to North Claiborne with asphalt. Chas. R. Kennedy, comptroller.

Seattle, Wash.—Bids are asked until March 3 for paving Tenth avenue and other streets with asphalt, for grading East Spring and other streets, and for constructing concrete sidewalks on Thirty-second and other streets. C. B. Bagley, secretary Board of Public Works.

Anderson, Ind.—Brick paving is contemplated. Bids are asked until March 15 for constructing 950 feet 20-, 950 feet 15-, and 750 feet 8-inch pipe sewer, and 1,200 feet 4-inch house connections. R. P. Mannix, city engineer.

Lebanon, O.—Bids are asked until March 16 for building a vitrified tile main sewer on Mulberry street. R. B. Corwin, village clerk.

Coffeyville, Kan.—Sealed bids are asked until March 14 for grading, curbing, and paving East Eighth street, requiring the following: 5,250 cubic yards grading; 15,815 square yards paving; 5,915 linear feet new cement curb; 675 linear feet old curb reset; 569 linear feet headers. Bids are asked until March 27 for the purchase of second-hand machinery as follows: 2 tubular boilers; 2 sets of gas burners and 3 sets of Zimmerman gas burners; full sets of suspension hangers for same; steam pipe; 1 60-kilowatt alternator; 1 Ideal engine; 1 water heater; gate valves, etc. Rosa Bell, city clerk.